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CONTENTS.

List of Officers, Session 1884-85 v

List of Members—

Honorary Members vi

Members vi

Associated Members xii

By-laws xiii

Secretaries' Report for 1884-85... xvii

President's Address—Metropolitan Sanitary Administration. By T. Orme Dudfield, M.D., Medical Officer of Health for Kensington 1

On the Supervision of Offensive Trades in the Metropolis. By Alfred Spencer, Chief Officer of the Special Purposes and Sanitary Branch, Metropolitan Board of Works 22

On the Status of the Medical Officer of Health as a Criterion of Sanitary Progress. By Henry E. Armstrong, Medical Officer of Health for Newcastle-upon-Tyne and the River Tyne Port 44

Are Small-pox Hospitals necessarily (*per se*) a Source of Danger to the Surrounding Population?—

I. By E. T. Wilson, M.B., Oxon., F.R.C.P., Physician to the Cheltenham General Hospital 64

II. By Edmund Gwynn, M.D., Medical Officer of Health to Hampstead 76

III. By J. W. Tripe, M.D., M.R.C.P.E., F.R. Met. Soc., etc., Medical Officer of Health to Hackney 81

Sewer Ventilation and House Sanitation. By William Weaver, A.M.I.C.E., F.S.I., Surveyor to the Vestry of Kensington 132

The Action of Disinfectants on Micro-Zooids. By A. Wynter Blyth, M.R.C.S., Medical Officer of Health to St. Marylebone 156

On Sewage Disposal. By Thomas Stevenson, M.D., F.R.C.P. 168

An Outbreak of Diarrhœa traced to Polluted Water. By F. E. Atkinson, L.R.C.P.,Lond., M.R.C.S., Medical Officer of Health to Craven Combined Sanitary District 187

The Etiology of Goitre in England. By W. N. Thursfield, M.D., Medical Officer of Health to Shropshire Combined Sanitary District 198

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The List of Officers for the Session 1885-86 *will be found on page xxxi.*

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A. CARPENTER, M.D., Lond., Duppas House, Croydon.
C. E. CASSAL, F.C.S., 12, Turle-road, Tollington-park, N.
A. COLLIE, M.D., Eastern District Hospital, The Grove, Homerton, E.
W. CROOKES, F.R.S., F.C.S., 7, Kensington Park-gardens, W.
W. EASSIE, C.E., 11, Argyll-street, Regent-street, W.
F. EAST, M.D., 2, Clapton-square, E.
J. J. EYRE, M.R.C.S., Vega House, Forest Hill, S.E.
A. FERGUS, M.D., F.F.P.S., Glasg., 3, Elmbank-crescent, Glasgow.
ROGERS FIELD, M.I.C.E., 4, Westminster-chambers, Victoria-street, S.W.
E. HART, M.R.C.S., 38, Wimpole-street, W.
THOS. HAWKSLEY, C.E., 30, Great George-street, Westminster, S.W.
G. A. HERON, M.D., 57, Harley-street, W.
F. HICKS, M.D., Hospital for Consumption, Brompton, S.W.
N. A. HUMPHREYS, Esq., General Register Office, Somerset House.
C. INNES, C.E., 1, Adam-street, Adelphi, W.C.
MARK JUDGE, A.R.I.B.A., 8, Park-place-villas, Paddington, W.
W. R. KEMP, 18, Talfourd-road, Peckham, S.E.
W. BARNES KINSEY, 5, Carteret-street, Queen Anne's-gate, Westminster, S.W.
G. B. LONGSTAFF, M.B., Southfield Grange, West-hill-road, Wandsworth, S.W.
J. A. D. MACKEY, 1, Westbourne-terrace, W.
J. B. MACKEY, 2, Bouverie-street, E.C.
LOUIS PARKES, M.D., 51, Cadogan-square, S.W.
C. RENNER, M.D., 80, Portsdown-road, Maida-vale, W.
EDWARD C. ROBINS, F.R.I.B.A., 14, John-street, Adelphi, W.C.
W. R. SMITH, M.D., Bayshill Villa, Cheltenham.
H. SAXON SNELL, F.R.I.B.A., 22, Southampton-buildings, W.C.
A. SPENCER, Metropolitan Board of Works, Spring-gardens, W.
J. SYMONDS, M.D., High-street, Tutbury, Staffordshire.
ERNEST TURNER, F.R.I.B.A., 246, Regent-street, W.
Prof. R. V. TUSON, Royal Veterinary College, Camden-town, N.W.
GEORGE WALLACE, C.E., 197, High Holborn, W.C.
W. WEAVER, C.E., Vestry Hall, Kensington, W.
C. WEST, M.D., 55, Harley-street, W.
W. WYNN WESTCOTT, M.B., Lond., 4, Torriano Avenue, N.W.
W. WHITAKER, B.A., H.M. Geological Survey Office, 28, Jermyn-street.
E. F. WILLOUGHBY, M.D., Bratton Lodge, Green-lanes, N.
E. T. WILSON, M.B., F.R.C.P., Lond., Westal, Cheltenham.

SOCIETY
OF
MEDICAL OFFICERS OF HEALTH.

BY-LAWS.
1885.

OBJECTS.

The objects of the Society are (*a*) the advancement of sanitary science, (*b*) mutual assistance in the performance of the duties of Medical Officers of Health.

CONSTITUTION.

MEMBERS.

All acting or retired Medical Officers of Health are eligible for election as Members.

HONORARY MEMBERS.

Distinguished persons known to interest themselves in matters relating to public health are eligible, on nomination by the Council, for election as Honorary Members.

ASSOCIATES.

Gentlemen not being Medical Officers of Health, but interested in the promotion of sanitary science, are eligible for election as Associates.

ELECTION OF MEMBERS AND ASSOCIATES.

Candidates for election as Members or Associates shall be proposed in writing by two Members at any ordinary or annual meeting, and shall be balloted for by the Members present at the following meeting. The names of candidates shall be announced in the notice convening the meeting at which the ballot is to take place, and no candidate shall be elected unless four-fifths of those voting shall be in favour of the election.

ELECTION OF HONORARY MEMBERS.

The names of persons nominated by the Council for election as Honorary Members shall be announced in the notice con-

vening the meeting at which the ballot is to take place, and no person shall be elected unless four-fifths of the Members voting shall be in favour of the election.

SUBSCRIPTIONS.

Members acting within the Metropolitan area shall pay an entrance-fee of one guinea and an annual subscription of one guinea.

Members acting without the Metropolitan area shall pay an annual subscription of half-a-guinea.

Retired Medical Officers of Health shall pay an annual subscription of half-a-guinea.

Associates shall pay an annual subscription of half-a-guinea.

Subscriptions, payable in advance, shall be due on the first day of October in each year, and in the case of new Members and Associates, within one month after election. Any Member or Associate neglecting to pay his subscription longer than twelve months after it shall have become due, shall be liable to have his name removed from the roll of the Society, and anyone not having paid his subscription for two years shall cease to belong to the Society.

PRIVILEGES OF HONORARY MEMBERS AND ASSOCIATES.

Honorary Members and Associates shall have the privilege of attending ordinary and special meetings, and of taking part in the discussions; but they shall not vote on any subject affecting the constitution, the management, or the discipline of the Society.

GENERAL MANAGEMENT.

The General Management of the Society shall be vested in a Council which shall consist of the Officers and of twelve Members, six of whom shall be Medical Officers of Health acting without the Metropolis. Three shall form a quorum.

The Officers of the Society shall consist of a President, four or more Vice-Presidents, a Treasurer, and two Secretaries.

The election of Officers and of other Members of the Council shall take place at the annual meeting, except in the case of vacancies arising from any cause, when a special meeting may be called for the purpose of filling such vacancies. Election shall be by ballot from Members of the Society duly proposed and seconded.

The Council shall consider and report on all matters referred

to it; it shall also audit the Treasurer's account previous to the Annual Meeting.

The President, the Secretaries, or any three Members of the Council, shall have the power of calling a meeting of the Council.

Committees for the consideration of special subjects may be appointed by the Society or by the Council.

The Officers shall be *ex officio* members of all Committees.

Meetings.

The annual meeting shall be held on a day to be previously fixed by the Council. At least seven days' notice of such meeting shall be given. Seven Members shall form a quorum.

The ordinary meetings shall be held at 7.30 p.m. on the third Friday in each month, from October to May inclusive. Seven Members shall form a quorum.

Special meetings may be convened by the President, the Secretaries, or on a requisition signed by five Members of the Society. Ten Members shall form a quorum.

The notice convening any meeting shall specify the business to be transacted thereat.

The President, if present, shall take the chair; in his absence it shall be taken by one of the Vice-Presidents. In the absence of the President and Vice-Presidents at the time fixed for the meeting, the Members present shall elect a chairman.

The Chairman shall determine what subjects other than those placed on the notice paper may be discussed at an ordinary or annual meeting.

Without the permission of the Chairman, no one taking part in the discussion of a paper shall speak more than once, or for a longer period than ten minutes.

All questions shall be decided by a majority of votes on a show of hands, and in case of an equality the Chairman shall have a casting vote.

The discussion of any subject may be adjourned to the next or any subsequent meeting.

Visitors may be introduced at any meeting other than an Annual Meeting either by a Member or by an Associate, and may take part in the discussions thereat.

The order of business at the annual meeting shall be as follows:—

Chair taken.
Minutes of last Annual Meeting.
Reports of Council and Committees.
Correspondence.

Treasurer's Annual Report.
Secretaries' Annual Report.
Election of Officers.
Members and Associates proposed.
Election of Members, Honorary Members, and Associates.
Miscellaneous business.

The order of business at ordinary meetings shall be as follows:—

Chair taken.
Minutes of last meeting.
Reports of Council and Committees.
Correspondence.
Members and Associates proposed.
Election of Members, Honorary Members, and Associates.
Miscellaneous business.
Papers read at 8 o'clock.

The time for the transaction of miscellaneous business may, by the vote of the meeting, be extended for a period not exceeding fifteen minutes.

The order of business at a special meeting shall be as follows:—

Chair taken.
Business specified on notice paper.

RESIGNATION OF MEMBERS.

Any Member desiring to withdraw from the Society shall signify the fact in writing to the Secretaries, but he shall be liable to pay whatever be due from him at the time of his withdrawal.

REMOVAL OF MEMBERS.

Whenever in the opinion of the Council there shall appear cause for the removal of any Member, Honorary Member or Associate from the Society, a statement of the circumstances shall be prepared by the Council and a copy of it shall be forwarded to the Members with the notice summoning the special meeting at which it is to be considered. On the question of such removal being put to the ballot, and on four-fifths of the members present voting for it, at least ten, including the Chairman, being present, the Chairman shall declare the Member, Honorary Member, or Associate to have been removed from the Society. Any one thus removed shall not be eligible for re-election except on the written nomination of six Members.

ALTERATIONS IN BY-LAWS.

Notice of any proposed alteration in the by-laws shall be sent by post to each Member at least seven days before the meeting at which the proposed alteration is to be considered.

SECRETARIES' ANNUAL REPORT

FOR THE SESSION 1884-85.

THE Secretaries are glad to be able to congratulate the Society on the conclusion of a very successful Session. Altogether, twenty-two meetings were held, viz., the Annual Meeting, twelve Ordinary Meetings, and nine Council Meetings, all of which, with the exception of the Annual Meeting, were held at 1, Adam Street, Adelphi.

The Society added largely to its strength during the Session, five honorary members, forty-five members, and thirteen associates having been elected. Its losses were two members and one associate by death, and by resignation, one member and one associate.

Subjoined is a list of members and associates elected, resigned, and deceased during the year :—

ELECTED.

Honorary Members.

Colonel Sir Francis Bolton, R.E., C.E.
Capt. Douglas Galton, C.B., R.E., F.R.S.
A. J. R. Trendell, M.A.
Professor R. Koch, M.D.
Professor L. Pasteur.

Members.

F. Argles, M.R.C.S , L.R.C.P., Wanstead.
T. L. Ash, M.R.C.S., L.R.C.P., Ed., Holsworthy and Okehampton R.S.D.
F. E. Atkinson, M.R.C.S., L.R.C.P., Lond., Craven Combined R.S.D.
H. L. Bernays, M.R.C.S., L.S.A., Charlton, Kent.
W. C. Blackett, M.R.C.S., L.S.A., Durham R.S.D., and Brandon U.S.D.
J. G. Blackman, M.R.C.S., L.S.A., Great Salterns.
A. S. Bostock, M.R.C.S., L.S.A., Whyke and Boxgrove.
H. Bullock, F.R C.S., L.S.A., Heston and Isleworth.
J. Burke, M.D., L.R.C S.I., Hatfield R.S.D.
H. Butterfield, M.R.C.S., L.S.A., West Kent R.S.D.
E. N. Carless, M.B., Devizes.
E. H. Carter, M.R.C.S., L.S.A., Chelmsford.
F. Carter, M.R.C.S., L.R.C.P., Billericay R.S.D.

W. M. Clark, M.R.C.S., L.R.C.P., Twickenham.
A. Clarke, M.R.C.S., L.R.C.P., Street.
J. W. Cook, M.D., Tendring R.S.D.
C. J. Denny, M.R.C.S., L.R.Q.C.P.I., Hartley-Wintney R.S.D.
A. L. Evans, M.R.C.S., L.R.C.P., 1st Dist. Hawarden Union.
H. J. Fausset, M.D., Tamworth U. and R.S.D.
E. F. Fussell, M.B., M.R.C.S., East Sussex Comb. S.D.
W. G. Groves, M.R.C.S., L.S.A., Woodford.
R. H. Hilliard, M.D., Aylesbury R.S.D.
R. B. Low, M.R.C.S., L.S.A., Helmsley.
J. Loane, M.R.C.S., M.R.C.P.E., Whitechapel.
W. C. Morris, M.B., M.R.C.S., Chester-le-Street.
A. A. Napper, M.R.C.S., L.S.A., Hambledon Union.
A. Newsholme, M.D., Clapham.
C. Roberts, M.R.C.S., L.S.A., Uxbridge R.S.D.
W. Robinson, M.D., M.R.C.S., Gateshead.
R. B. Rygate, M.B., St. George's-in-the-East.
F. Scott, M.R.C.S., L.S.A., Edmonton.
J. Shaw, M.R.C.S., L.S.A., Rotherhithe.
W. Stamford, M.R.C.S., L.R.C.P., Tunbridge Wells.
E. H. W. Swete, M.D., Droitwich U. and R.S.D.
J. F. J. Sykes, M.B., St. Pancras
W. J. Sykes, M.D., Portsmouth.
E. J. Syson, L.R.C.S., L.R.C.P., St. Neots, Stamford, Caxton, and Whitlesea R.S.D.
J. S. Taylor, M.D., Liverpool.
E. Walford, M.R.C.S., L.S.A., Ramsgate.
H. Welch, M.B., Blackpool.
T. Wheeler, M.R.C.S., L.S.A., Bexley U.S.D., and Dartford Union.
B. A. Whitelegge, M.D., Nottingham.
J. M. Wilson, M.D., Doncaster, Tadcaster, etc., R.S.D.
W. D. Wood, L.R.C.P., Oxford Comb. R.S.D.
G. E. Yarrow, M.D., St. Luke's.

Associates.

J. J. Eyre, L.K.Q.C.P.I., Vega House, Forest Hill, S.E.
W. Eassie, C.E., 11, Argyll Street, W.
Rogers Field, B.A., M.I.C.E., 4, Westminster Chambers, S.W.
Mark Judge, A.R.I.B.A., 8, Park Place Villas, W.
W. B. Kinsey, C.E., 5, Carteret Street, Westminster.
L. Parkes, M.D., 51, Cadogan Square, S.W.
E. C. Robins, F.R.I.B.A., 14, John Street, Adelphi, W.C.
W. R. Smith, M.D., Bayshill Villa, Cheltenham.
H. Saxon Snell, F.R.I.B.A., 22, Southampton Buildings, W.C.
E. Turner, F.R.I.B.A., 246, Regent Street, W.
G. Wallace, C.E., 197, High Holborn, W.C.
W. Weaver, C.E., Vestry Hall, Kensington, W.
W. W. Westcott, M.B., 4, Torriano Avenue, N.W.

Resigned.

F. B. Jessett, F.R.C.S, 16, Upper Wimpole Street (Retired M.O.H.).
W. Fairbank, M.R.C.S., Windsor (Associate).

Deceased.

F. W. Coates, M.D., Salisbury (M.O.H.).
F. Liddle, M.R.C.S., Whitechapel (Retired M.O.H.).
B. Washbourne, M.D., Gloucester (Associate).

The roll of the Society now includes twenty-three honorary members, one hundred and sixty-one members, and forty associates.

Dr. T. Orme Dudfield, who had succeeded Dr. Tripe as President in 1883, ably presided over the Society during the past Session.

The Session was inaugurated by the delivery of the Presidential address on Metropolitan Sanitary Administration, in which Dr. Dudfield continued his consideration of the subject of Metropolitan Government, which formed the basis of his introductory address at the beginning of the previous session. By resolution of the Society the President's address was printed, and copies were sent to the Vestries, the Metropolitan Board of Works, the Metropolitan Asylums Board, the Royal Commission for Housing of the Poor, and the Corporation of the city of London. The following papers were read:— "The Supervision of Noxious Trades", by Mr. Alfred Spencer; "Sewer Ventilation and House Sanitation", by Mr. Weaver; "Sewage Disposal", by Dr. Thomas Stevenson; "The Action of Disinfectants on Microzooids", by Mr. Wynter Blyth; "The Etiology of Goitre in England", by Dr. Thursfield; "An Outbreak of Diarrhœa traced to Polluted Water", by Mr. F. E. Atkinson; "The Status of the Medical Officer of Health", by Mr. H. E. Armstrong. The subject which perhaps excited the greatest degree of interest was that of the influence of Small-pox Hospitals, which was brought under the consideration of the Society by Drs. Wilson, Tripe, and Gwynn. Drs. Tripe and Gwynn had had experience of the effect of a small-pox hospital upon its surrounding neighbourhood, and at the request of the President read a paper on the question whether small-pox hospitals are necessarily a source of danger to the surrounding population. Dr. Wilson's paper took the form of a criticism of the views on aerial dissemination of *contagium*, as expounded by Mr. W. H. Power in his report on the Fulham Hospital. The papers were well fitted to enable the Society to consider the subject with which they dealt, and with the discussion, which continued over three meetings, now form a valuable portion of the volume of the *Transactions* of the year.

In other respects the work of the Society has not been less important than in previous years. The by-laws were carefully revised; and among the chief features of the Session was the presentation of a testimonial to Dr. J. Northcote Vinen, on his resignation of the office of Honorary Secretary, which he had held to the great advantage of the Society for more than twenty years.

Among other subjects, the Rivers Pollution Bill was considered; but the Bill having been withdrawn, the Council, to which it had been referred, deferred their report. The Water Companies Regulation of Powers Bill was considered by the Society, and it was determined to present a petition to Parliament in support of the Bill so far as it related to direct sanitary questions. The Earl of Camperdown, who had charge of the Bill, requested the Society to nominate one of its members to give evidence before the Select Committee, and the President was accordingly nominated, but his evidence was not required. The Bill ultimately fell through.

The North-Western Association of Medical Officers of Health suggested the formation of a joint Committee with a view to take action to remedy the unsatisfactory position of Medical Officers of Health as regards the tenure of office, and requested the co-operation of this Society. The Society nominated five of its members, and a similar number was appointed by the North-Western Association.

The first meeting of the joint Committee was held July 16th, the President of the Society being in the chair.

Brick-burning.

The subject of brick-burning came prominently before the Society in the course of the session.

In December 1884 the Council presented a report on the subject, in which it was stated that "brick-burning has engaged the attention of many Medical Officers of Health on account of the very general complaints of the noxious effluvia resulting from the process. In various parts of the metropolis, at distances considerably removed from the brick-fields, much alarm has been occasioned by the effluvia simulating the smell of sewer-air, and complaint has been made of stinks referred to sewer-air which have been conclusively traced to brick-burning in the suburbs. During the sultry weather of last summer many persons allege that they were compelled to get up in the middle of the night and close their windows, so offensive was the smell; and in addition to the more remote effects due to such interference with ventilation, to say

nothing of comfort, there have been direct cases of sickness traced to this cause." . The Council was of opinion "that there are sufficient reasons for regulating this trade by by-laws, as other offensive trades have been, with such manifest advantage to the public, and that, owing to the considerable distance the effluvia travel, and to the fact that many of the brick-fields contributing to the nuisance are outside the metropolitan area, legislation should be general, and should apply to areas within a specified distance of all centres of population."

The report was adopted, and since this event important legal decisions have, in the spring of this year, been given in two cases in which the plaintiffs brought actions to restrain a nuisance alleged to be caused by brick-burning. The first case, Dunston *v.* Neal, related to a brick-field at Streatham. Two plaintiffs, living four hundred and eight hundred yards respectively from the source of nuisance, complained that they were unable to open their windows on account of the fumes, which gave rise to nausea, loss of appetite, and headache. Evidence was also given to show that other persons in the neighbourhood had suffered in a like manner, and that the smell could be traced a distance of a mile. The number of bricks made by the defendants in 1884 was two million one hundred thousand, the quantity of material used being five hundred yards of dust-bin refuse, four hundred to five hundred yards of road scrapings, and five thousand yards of clay. Mr. Justice Cave delivered judgment for the plaintiffs ; his lordship stating that the evidence laid before him had not proved that the burning of the bricks caused a nuisance injurious to health, in the sense of producing disease or illness, but he was satisfied that there was a nuisance which affected the plaintiffs in the comfort and enjoyment of their houses. The second case, Hampstead Vestry *v.* Elt, related to a brick-field at Hampstead, the proceedings having been taken in the interest of the ratepayers. Mr. Justice Wills visited the brick-fields at the request of the defendants, and on returning to court stated that he found a nuisance to exist. With the consent of the defendants the case was stopped, his lordship delivering judgment in favour of the plaintiffs with costs.

The Society thereupon addressed a letter to the Metropolitan Board of Works, urging the necessity for legislation for regulating brick-burning when carried on in proximity to inhabited dwelling-houses, and inviting the Board to introduce a Bill for dealing with the matter. It was pointed out the nuisance arose from

1. The material which enters into the composition of the brick itself, such as dust-bin refuse and road sweepings.

2. The admixture of organic matter from dust-bins, etc., with the fuel used for burning the bricks.

3. The method of burning bricks in open clamps.

The decision of the Board has not been made known.

Surplus Fund of the International Health Exhibition.

The disposal of this fund was brought before the Society by Dr. Corfield, and after due consideration, a memorial was addressed to the Prince of Wales, as President of the exhibition, submitting for His Royal Highness's consideration the desirability of appropriating the surplus for the establishment of laboratories for biological and chemical research, on the lines of those in operation during the continuance of the exhibition, together with a central institute where the principles of public health in all its branches could be taught, and where the various societies engaged in the cultivation of that science could hold their meetings; the institution of a museum, library, and class-rooms was also recommended. Similar memorials were addressed to His Royal Highness by other societies engaged in labours having for their object the improvement of the public health. As yet no decision as to the disposal of the surplus appears to have been arrived at.

Hospital Provision for Cholera.

The prevalence of Cholera on the Continent, and the possibility of its appearance in England, brought prominently before the Society the necessity for considering the steps which might have to be taken in the event of the disease invading this country. The passing of the Diseases Prevention (Metropolis) Act, 1883, had altered the arrangements existing in the metropolis, in past epidemics, for dealing with cholera by relieving the vestries and district boards of the duty of making the whole of the hospital provision for this disease, for by its provisions the Metropolitan Asylums Board, which had in practice become the hospital providing authority for infectious diseases among all classes of the community, was created a Local Authority, and this Board wisely determined to place itself in communication with the Metropolitan Medical Officers of Health, with the view of making the necessary arrangements to the utmost practicable advantage.

On July 17, 1884, a conference was held at the offices of the Board, between the General Purposes Committee and the Medical Officers of Health; the object of the conference, as explained by Sir Edmund

Currie, being to enable the Committee to ascertain what steps it was desirable to take in view of the threatened introduction of cholera into London. In order to facilitate the consideration of the subject, the General Purposes Committee had prepared a Memorandum as to the provision of hospital accommodation for cholera cases.

The Memorandum pointed out that the Diseases Prevention (Metropolis) Act, 1883, constitutes the Managers of the Metropolitan Asylum District, within that district, a Local Authority under the Diseases Prevention Act, 1855, for such purposes of the said Act, and with such powers and duties as may from time to time be specified by an order of the Local Government Board.

Subject to the provisions of such order, the Managers may from time to time utilise any of their buildings, ambulances, and other property, and their staff, for the execution of any powers or duties conferred or imposed on them under the several Acts.

It is enacted that any authority or body of persons having the management and control of any hospital, infirmary, asylum, or workhouse may from time to time let the same or any part thereof to the Managers; or may enter into and carry into effect contracts with the Managers for the reception, treatment, and maintenance therein of persons suffering from cholera within the district of the Managers, and that the admission of a person suffering from infectious disease into any hospital or hospital ship provided by the Managers, or the maintenance of any such person therein, shall not be considered to be parochial relief, alms, or charitable allowance to any person, or to the parent of any person; and no such person or his parent shall by reason thereof be deprived of any right or privilege, or be subject to any disability or disqualification.

The Memorandum cited a letter from the Local Government Board to the effect that if it should become necessary to put in force in the metropolis the Diseases Prevention Act, 1855, the Board proposed that the Managers of the Asylum District, as a "Local Authority", should have assigned to them by order of the Board the duty of providing within certain limits hospital accommodation for cholera patients for the whole metropolitan area, irrespective of parochial boundaries, regard being had on the one hand to the density of the population, and on the other to the proximity of the population to the hospitals.

The general principle laid down was that a mile should be regarded as the limit of distance that a patient should be removed.

The Managers were requested to consider what accommodation for cholera patients might be obtained in their own buildings, in general hospitals, and in the poor-law infirmaries; and it was suggested that in those parts of the metropolis where such accommodation could not be obtained, the Managers might be able to negotiate for the temporary use of empty buildings or for the acquirement of plots of land on which, in case of emergency, huts could be erected. It was further pointed out, however, that in the event of cholera prevailing in any particular district, the sanitary authority of that district would be called upon to make special provision of its own, firstly, of hospitals for the sick, and secondly, of refuges for healthy inmates of houses wherein sick persons were under treatment, should the moderate provision, to which the Managers must necessarily restrict themselves, be exceeded.

It was stated that the Managers were prepared to provide one thousand five hundred beds in existing institutions, and they proposed to place wheeled litters and hand-stretchers at each hospital, and to arrange for bearers. They desired the opinion of the Medical Officers of Health, in advising, firstly, as to whether the proposed hospitals were in the proper situations, as indicated on the maps which had been prepared, and, secondly, they requested them to give information of suitable positions for additional hospitals. The Medical Officers were also invited to submit the names of gentlemen who would be willing and were competent to take charge of cholera hospitals, and also to express their opinion as to the proper means to be adopted for dealing with the sewage from cholera hospitals.

The observations of the Medical Officers were also asked on the following proposed regulations:—

"1. On the occurrence of a case of cholera, or suspected cholera, in any house, it shall be competent to any medical practitioner to certify to the fact, and in the event of his judging it expedient that the case should be removed, and of his transmitting information to this effect to the nearest hospital or infirmary, it shall be the duty of the official in charge of the ambulance attached to that institution to forthwith proceed with the ambulance to the sick person's house, and receive instructions for the removal of the case from the medical practitioner who shall have certified.

"2. Whether the patient is or is not in a condition to be removed to hospital, it shall be the duty of the practitioner to forthwith advise the Medical Officer of Health of the existence of the case, in order that he may be kept thoroughly acquainted with the progress of the disease in his district.

"3. A return of the number of cholera cases shall be forwarded daily from each hospital and infirmary to the nearest Medical Officer of Health, and a duplicate copy sent to the Managers."

They were further requested to consider:

"(*a*) In what manner the inhabitants of a parish may be made acquainted with the steps to be taken for the removal of cases to hospital, in order to ensure the inhabitants' co-operation in giving effect to the arrangements made.

"(*b*) In what way their duties and those of the Managers, in connection with this particular subject, could be arranged so as to bring about the harmonious working of the different authorities sending and treating patients.

"(*c*) What other steps, if any, they would suggest should be taken in the matter of hospital accommodation of cholera cases."

At the Conference the subject was discussed generally, and subsequently the Society decided to address the following communication

to the Board, stating the views of the Metropolitan Medical Officers of Health on the several points raised by the Memorandum.

"Society of Medical Officers of Health,

"1, Adam Street, Adelphi, W.C.,

"*September 17th*, 1884.

"Sir,—We are requested by the Society of Medical Officers of Health to ask you to submit to the General Purposes Committee of the Metropolitan Asylums Board the following remarks and suggestions which the Society desire to offer on the memorandum of the Committee as to the provision of hospital accommodation for cholera cases.

"In the first instance we are directed to state that the Society will gladly do whatever lies in their power to aid the Committee in the discharge of the important duties which would devolve upon the Board under the Diseases Prevention (Metropolis) Act, 1883, should cholera invade this country, and will, with this object, request the metropolitan members to furnish information of suitable sites and buildings which might be made available for hospital purposes.

"With a view to enabling Medical Officers of Health to assist the Committee by naming gentlemen able and willing to take medical charge of cholera hospitals, we are desired to request further information as to the views of the Committee, and especially:

"(*a*) Whether the Hospital Medical Officer would be required to reside in the hospital and devote the whole of his time to the duties of his office.

"(*b*) The minimum period of engagement.

"(*c*) The amount of proposed remuneration.

"In reference to the request for information on the best method of dealing with the sewage of cholera hospitals, the Society desire to point out that the infectious elements of cholera are contained in the matters that proceed from the stomach and bowels of a person suffering from this disease, and that the immediate disinfection of these is all-important. The Society therefore recommend, as a useful and economic plan, the addition to the evacuations, before their discharge into the drains, of at least a fourth part of a solution of green copperas (sulphate of iron) of a strength of 5 lbs. to a gallon of water. To each gallon of solution 8 oz. of carbolic acid (Calvert's No. 5) might be added with advantage.

"The Society would furthermore recommend that the litters used for the removal of persons suffering from cholera should be provided with waterproof so arranged that the pollution of the roadways with the evacuations of the patient should be impossible, and that in the management of the Hospitals precautions should be taken to protect the bedding from similar pollution. Should such an accident occur, the bedding should be destroyed, and the linen disinfected in a solution of carbolic acid of a strength of two per cent., or of chloride of zinc of a strength of 25 grains in the ounce.

"The Society note with satisfaction the steps the Committee propose should be taken for the purpose of isolating cases of cholera; but while fully concurring with the opinion of the Committee that medical practitioners should inform the Medical Officer of Health of all cases of cholera coming under their care, the

Society desire to point out that there is as yet no legal provision for ensuring the communication of such information, and unless the Local Government Board should make an order, under the Diseases Prevention Act, 1855, for this purpose, if they have power so to do, or promote special legislation to secure this object, they fear that the information will in many cases not be given.

"For the rest, the Society would recommend that a daily return of the cases of cholera admitted into each hospital should be sent to the Medical Officer of Health of the district from which the cases are received; that the Vestries and District Boards should undertake the duty of making the inhabitants of the several parishes and districts acquainted with the steps to be taken to secure the removal to hospital of cases of cholera; and the Society believe that the harmonious working of the several authorities would be promoted by placing the Medical Officers of the several hospitals in direct communication with the Medical Officers of Health in the hospital district.

"We have only to add that the above suggestions were unanimously agreed upon at a meeting of the Metropolitan members of the Society called to consider the memorandum of the General Purposes Committee, and that any further information or explanation will be most willingly furnished by us.

"We are, sir,

"Your obedient servants,

"SHIRLEY F. MURPHY,
"C. E. SAUNDERS, M.D., } *Hon. Secs.*

"*To* W. F JEBB, ESQ.,

"*Clerk to the Metropolitan Asylums Board.*"

A communication was subsequently received from the Metropolitan Asylums Board asking for the particulars of any properties which the several Medical Officers of Health might consider suitable, and which could be obtained for cholera hospital purposes, and stating that it was proposed to establish ambulance stations, not only at the several institutions where cholera cases were treated, but at other convenient points in each district. It was further stated :—

1. That the Medical Officer to a cholera hospital would be required to reside in or near the hospital, and to devote the whole of his time to his duties.

2. That he would be engaged for a minimum period of three months, and at liberal salary.

3. That each Medical Officer of Health would be kept well informed as to the progress of the disease in his district by means of daily returns from the hospitals in or contiguous to his district.

Subsequently, on November 29th, a letter was addressed by the Metropolitan Asylums Board to the clerks to the Vestries and District Boards of the metropolis, asking permission, in the event of an outbreak of cholera, for the Managers to place ambulance stations at convenient spots in wide thoroughfares, a proposal which appears

to have been unfavourably received by many of the Sanitary Authorities. The stations were to have taken the form of small wooden buildings on wheels, similar to a cabman's shelter or a contractor's portable office.

On the last day of the Society's year a conference was held between Dr. George Buchanan, F.R.S., Medical Officer of the Local Government Board, and the Metropolitan Medical Officers of Health, at the Society's rooms, the President in the chair.

In opening the proceedings, Dr. Dudfield reminded the meeting that, in 1884, when cholera made its appearance in France, a conference to concert measures of defence for London was held by the Medical Officers of Health, with the General Purposes Committee of the Metropolitan Asylums Board, that Board having been constituted a "Local Authority", under the Diseases Prevention Act, 1855, by the Diseases Prevention (Metropolis) Act, 1883. One of the objects of the latter Act was to make better provision, as regards the metropolis, for the isolation and treatment of persons suffering from cholera, and by it the Board was enabled to utilise its buildings, ambulances, and staff, for the execution of the powers and duties imposed on it under both of the Acts. Immediately after the passing of the Act, the Board resolved to provide accommodation for cholera patients in the metropolis, as a whole, without respect to parochial boundaries, partly by the use of its own hospitals, partly by the acquisition of sites for huts, and partly by arrangements for the use of beds at general hospitals, at infirmaries, and workhouses. The beds placed at the disposal of the Managers were about one thousand seven hundred, irrespective of two hundred and fifty available at their own hospitals. The design in the proposed arrangements was to constitute the Managers a first line of defence for immediate action on the appearance of cholera. Had cholera come, the other Local Authorities (the Vestries, etc.) would have been liable to provide additional accommodation for the sick, if necessary, as well as refuges for the other inhabitants of houses where there were cholera patients too ill to be removed to a hospital. The questions considered by the conference were mainly how an epidemic of cholera could best be met, and what convenient buildings or sites for hospitals could be made available in the several districts. The Committee had previously addressed a communication to the Medical Officers of Health in which questions connected with provision of hospitals, disinfection of excreta, hand-ambulances, notification of cholera cases, etc., were dealt with, and

to that communication a collective reply was sent, in September last, through the Secretaries of the Society of Medical Officers of Health. In 1883, and again in 1884, the Local Government Board addressed communications to the several "Local Authorities" with reference to cholera. The Board also issued two Orders, with a covering explanatory letter; one addressed to the Port of London Sanitary Authority, who, of necessity, would constitute the outer line of defence; and the second addressed to all the other Port Sanitary Authorities, etc. The Board also forwarded, for the information of all Sanitary Authorities, a "Memorandum", prepared by their Medical Officer, on "Precautions against the Infection of Cholera". The regulations issued by the Board in 1866, imposed on the Vestries, etc., as "Local Authorities", the duty of making arrangements for the prevention and treatment of cholera, including the medical visitation of the houses of the poorer classes, for the purpose of detecting cholera and diarrhœa, and the supply of medical attendance and nursing, and of medicine and disinfectants. What the Board had done in the past might be taken as an indication of what the Board would be likely to do in the future, should occasion arise. It was to be supposed, also, that the arrangements of the Asylums Board, made in 1883 and 1884, would hold good at the present time, should the dreaded emergency arise.

Dr. Buchanan then made some observations, in the course of which he said that the threat of cholera in 1883 was more serious than that which was now exciting attention, it being a peculiarity of cholera in Europe that it usually made a threatening appearance for about three years in succession, and then was heard of no more for a time. His object in desiring to take counsel with the Medical Officers of Health was to avoid fuss and panic. In this country no confidence was reposed in quarantine, but much in the practice of medical inspection through the officers of the several Port Sanitary Authorities. The duties of those authorities were defined by the Board's order of 1883. A vessel coming from an infected country was required to anchor where ordered until inspected. If found healthy, all passengers were allowed to go free. If there were any sick on board they were detained, the healthy being allowed to depart, their several destinations being recorded, and the vessel was disinfected. The Board had been looking to the defences of the principal ports, by inspections made in 1884. During the present year the survey had been extended, and the various arrangements had been investigated, including the provision of

hospital accommodation. The Board's inspectors had looked closely to the condition of the several towns, and to see how the local authorities were doing their work. At some of the ports the arrangements were very satisfactory, the authorities being careful and thoughtful in their preparations. At others there were shortcomings. The inspectors had striven to rouse less careful authorities. A principal danger to be guarded against was the importation of cholera in rags, and so it had been arranged that rags should not be imported without proper precautions against possible mischief. With reference to the Society's views on the supervision of the water-supply, from its sources to the consumers' cisterns, expressed at the Conference in 1883, he had conveyed them to the Board. In Colonel Sir Francis Bolton, the water examiner, the Board had an officer who devoted much thought and attention to this important subject. His reports showed the work done by the Companies to safeguard the supply. In 1883 the Sanitary Authorities took steps for securing the purity of the water in the cisterns, and this combination of local vigilance with central vigilance should be continuous. With respect to hospital provision it should be remembered, as had been stated, that the Metropolitan Asylums Board could only arrange to provide a first line of defence. The two thousand beds they were said to be able to provide would be very useful, but it was important to inquire as to the convenience of the proposed hospitals in point of nearness to those of the sick who would be likely to require hospital treatment. The Vestries and District Boards would form the second line of defence, and this would be the more important should cholera come. The Vestries would have to provide places of refuge for the healthy when the sick were too ill to be removed. With this branch of work, probably the most important, as being the best way of dealing with cholera, the Metropolitan Asylums Board would have nothing to do, nor with the provision of disinfectants, medicines, etc. He concluded by inviting suggestions from the Officers of Health.

A discussion followed, in which the Medical Officers of Health for Poplar, Bermondsey, Marylebone, Newington, the Strand, Chelsea, and Battersea, among others, took part; the general feeling being—and with this the Medical Officer to the Board agreed—that in the event of cholera making its appearance the Local Sanitary Authorities should be prepared to undertake the same duty which devolved upon them before the Metropolitan Asylums Board was constituted an authority under the Diseases Prevention Act,—not resting too much

on what that Board might be able to do, but depending primarily on their own efforts, alike for removing those conditions which allowed of the spread of cholera, and for dealing with the disease if it became epidemic.

Happily, up to the present time, cholera has not made its appearance in this country.

Hospital Provision for Infectious Diseases in the Metropolis.

The subject of the reception and treatment of non-pauper patients in the hospitals of the Metropolitan Asylums Board was again before the Society during the past Session. The occasion for the reconsideration of this matter was the issue by the General Purposes Committee of that Board of a Memorandum, in which the several resolutions of the Committee and of the Board bearing on this subject were discussed. The Memorandum referred to the opportunity given by the Poor-law Act of 1879 for the Vestries and District Boards to contract with the Managers for the treatment of non-pauper patients in the hospitals of the Board, at the cost, in the first instance, of the several Sanitary Authorities. No action had been taken under this measure hitherto.

The Diseases Prevention (Metropolis) Act, 1883, enacted that "the admission of any person suffering from infectious disease into any hospital or hospital-ship provided by the Managers, or the maintenance of any such person therein, shall not be considered to be parochial relief." The General Purposes Committee therefore were of opinion that the time had arrived "when persons suffering from dangerous infectious disorders should be admitted to the Managers' hospitals upon the orders of the Medical Officers of Health as well as upon the orders of the Relieving Officers," and they accordingly recommended that the Local Government Board be requested to place themselves in communication with the several Local Authorities of the metropolis with a view to issuing an Order to empower the Managers (in accordance with the terms of Section 15 of the Poor-law Act of 1879) to contract with such Authorities for the reception into the Managers' hospitals of cases of dangerous infectious disorders other than those chargeable to the various parishes and unions.

After full consideration, the Society, on the recommendation of the Council, resolved that "having taken into consideration the special

report of the General Purposes Committee of the Metropolitan Asylums Board, with the knowledge of the fact that in some parishes and districts, from want of co-operation between the Poor-law and Sanitary Authorities, difficulty had been experienced in obtaining the removal to the Asylums Board Hospitals of cases of infectious disease, the Society cannot but approve the plan of contracts suggested by the Managers under the provisions of the Poor-law Act of 1879, clause 15. At the same time, the Society is of opinion that as admission into the hospitals no longer entails pauperisation, cases should be received upon the certificate of any medical practitioner ; that the expenses of treating cases in the hospitals should be defrayed out of a common sanitary fund (the metropolis being treated as a single district for the purpose), and that no compulsory payment should be exacted from persons removed to hospitals for the purpose of isolation." This resolution was duly forwarded to the Board.

The Annual Meeting of the Society was held at the Holborn Restaurant on July 16, when the members and their friends subsequently dined together.

At the meeting the following gentlemen were elected as office bearers for the ensuing session, 1885-86 :—

President.

W. H. CORFIELD, M.D., F.R.C.P.

Vice-Presidents.

A. WYNTER BLYTH, M.R.C.S.
T. ORME DUDFIELD, M.D.
ALFRED HILL, M.D.
CHARLES KELLY, M.D.
J. NORTHCOTE VINEN, M.D.

Treasurer.

S. R. LOVETT, L.R.C.P., Edin.

Secretaries.

SHIRLEY F. MURPHY, M.R.C.S.
CHARLES ED. SAUNDERS, M.D.

Council.

W. ARMISTEAD, M.B.
H. E. ARMSTRONG, M.R.C.S.
J. S. BRISTOWE, M.D., F.R.S.
G. BUCHANAN, M.D., F.R.S.
W. COLLINGRIDGE, M.D.
E. GWYNN, M.D.
J. ROWLAND, M.D.
E. C. SEATON, M.D.
J. SHEA, M.A.
J. W. TRIPE, M.D.
G. TURNER, M.B.
W. T. G. WOODFORDE, M.D.

The Treasurer's accounts were presented to the Society; the balance sheet, which had been audited and found correct by Mr. A. Wynter Blyth and Dr. John T. Rowland, showed that the subscriptions and entrance fees received during the year amounted to £119 9s. 6d., which, with a balance of £2 15s. 9d. brought forward from the previous session, amounted to £122 5s. 3d. The total expenditure, consisting of £76 3s. 2d. for printing, £19 2s. for rent of meeting room, etc., and other minor expenses, equalled £129 3s., leaving a balance of £6 17s. 9d. due to the Treasurer.

The first meeting of the Session 1885-86 will be held at 1, Adam Street, Adelphi, on October 16th, 1885, at 7.30 p.m., when an inaugural address will be delivered by the President, Dr. W. H. Corfield, on "The History of House Sanitation".

SHIRLEY F. MURPHY,
C. E. SAUNDERS, M.D.,} *Hon. Secs.*

July 1885.

FINANCIAL STATEMENT OF THE SOCIETY OF MEDICAL OFFICERS OF HEALTH.

Receipts and Expenditure from July 1st, 1884, to June 30th, 1885.

S. R. LOVETT, L.R.C.P., Treasurer.

Dr. CASH.

	£	s.	d.
To balance brought forward, 1884	2	15	9
To subscribers and entrance fees, etc.	119	9	6
	£122	5	3

CONTRA. *Cr.*

	£	s.	d.
Tea and Coffee	8	13	0
Gratuity to Attendant	1	0	0
Use of Library—1, Adam Street	9	9	0
Shorthand writer (Mr. Mills)	5	5	0
Roberts and Leete (Printers)	75	5	2
Harrison (Printer)	0	17	0
Tebay (Engraver)	4	0	0
Stanford (Engraver)	3	3	0
Beckmann (Frame Maker)	1	10	6
Crutch (Lithographer)	1	10	0
The President, Disbursements at Conference ...	4	0	0
The Secretary, Mr. Shirley Murphy, Petty Cash ...	9	6	4
,, Dr. C. E. Saunders, ,, ...	2	0	0
The Treasurer, Mr. S. R. Lovett ,, ...	3	4	0
	£129	3	0
	£122	5	3
Balance due to Treasurer	£6	17	9

Audited, June 11th, 1885.

A. WYNTER BLYTH.
JOHN T. ROWLAND.

TRANSACTIONS OF THE SOCIETY DURING THE SESSION 1884-85.

INAUGURAL ADDRESS

ON

METROPOLITAN SANITARY ADMINISTRATION,

BY

T. ORME DUDFIELD, M.D., *President.*

Delivered October 17th, 1884.

INTRODUCTORY.

I CANNOT more fitly commence my address in opening the proceedings of another Session than by congratulating the Society on the success of the Conference at the International Health Exhibition in June last. The Conference, as you will remember, was the outcome of an invitation addressed to me, as your President, by the Duke of Buckingham, Chairman of the General Committee of the Exhibition, who suggested for its subject "some question connected with Domestic Sanitation in Rural Districts." The invitation having been cordially accepted, the Society authorised the Council to make the necessary arrangements, and in the event it was settled that the Conference should extend over six days: the subjects selected for discussion, and the readers of papers being as follows:—

"Domestic Sanitary Arrangements of the Metropolitan Poor"—Dr. Tripe.

"Domestic Sanitation in Rural Districts"—Dr. George Wilson.

"Industrial Diseases"—Dr. Bristowe.

"Cows' Milk as a Vehicle of Infectious and Epidemic Diseases"—Dr. Thursfield.

"Notification of Infectious Disease: its Importance and its Difficulties"—Dr. Alfred Hill.

"Disposal of the Dead"—Mr. A. Wynter Blyth.

Subsequently, a similar invitation was addressed to the Sanitary

Institute of Great Britain and to the Parkes Museum of Hygiene, but before these bodies had had time to make their arrangements, a further communication from the Executive Council of the Exhibition suggested the desirability of a Conference being managed conjointly by the three Societies. The following joint Committee of the three Societies was then appointed to carry out the details :—

T. Orme Dudfield, M.D., *Chairman.* J. Syer Bristowe, M.D., F.R.S. A. Wynter Blyth, M.R.C.S.	*Representing the Society of Medical Officers of Health.*
Alfred Carpenter, M.D., J.P. W. H. Corfield, M.A., M.D. Ernest Turner, F.R.I.B.A.	*Representing the Sanitary Institute of Great Britain.*
Douglas Galton, Capt. R.E., C.B., F.R.S. Rogers Field, B.A., M. Inst. C.E. Louis Parkes, M.D., *Secretary.*	*Representing the Parkes Museum of Hygiene.*

The meetings of the joint Committee were held in this room. The scheme of the Society was approved by the delegates of the sister societies, and strengthened by their selection of additional subjects for papers, and nomination of readers, as follows :

"The Improvement of the Sanitary Arrangements of Metropolitan Houses"—Mr. Ernest Turner.

"Sanitary Houses for the Working Classes in Urban Districts"—Mr. Percy Boulnois.

"How Infectious Diseases are Spread"—Dr. Corfield.

"The Right of the State to Enforce Notification of Infectious Diseases"—Dr. Alfred Carpenter.

"Cremation"—Mr. W. Eassie.

The following gentlemen were appointed to preside at the several meetings of the Conference :—

Sir James M'Garel Hogg, Bart., M.P., Chairman of the Metropolitan Board of Works.

Captain Douglas Galton, R.E., C.B., F.R.S., Chairman of Council of the Parkes Museum.

The Duke of Northumberland, K.G., President of the Sanitary Institute.

Alfred Carpenter, M.D., Chairman of Council Sanitary Institute.

The Earl Fortescue, Vice-President of the Parkes Museum.

T. Orme Dudfield, M.D., President of the Society of Medical Officers of Health.

Owing to sudden and severe indisposition, the Duke of Northumberland was unable to preside, but his place was ably filled by that veteran sanitarian, Mr. Edwin Chadwick, C.B., Vice-President of the Sanitary Institute. The duty of opening the Conference devolved upon your President, owing to the absence from England of Sir James McGarel Hogg, who kindly consented to exchange places, and preside at the final meeting.

The Conference, as I have said, was a complete success. The papers were uniformly good. The discussion each day was sustained with spirit and unflagging interest ; the attendance was large and representative, and the results of the proceedings have been collected in a goodly volume of Transactions, ably edited by Dr. Louis Parkes. It would be unjust not to mention here that much of the success was due to the admirable arrangements made on behalf of the authorities by Mr. Trendell, the Literary Superintendent of the Exhibition, whose courtesy and attention were suitably acknowledged in a letter of thanks addressed by the joint Committee to the Executive Council.

It is the custom of this Society to hold its annual meeting in July, but in anticipation of the presence in town of many of our country brethren, it seemed good to the Council to arrange for the meeting to take place at the Exhibition during the progress of the Conference. The result was all that could be desired ; the attendance was large, and at the banquet which closed the proceedings of the day, more than one hundred members and friends, including ladies, sat down. The delegates of the Sanitary Institute and the Parkes Museum honoured the Society with their company as guests. To the success and pleasure of the meeting there was but one drawback, in the absence of a familiar face, that of our late highly-esteemed hon. secretary, Dr. Northcote Vinen, who was kept away by the illness which had already compelled him to relinquish an office which he had filled with conspicuous zeal for more than twenty years. The Society, however, which had accepted Dr. Vinen's resignation with sincere regret, and had resolved to mark its sense of the value of his services by a complimentary presentation, had some compensation for their loss in the opportunity afforded by the vacancy of giving effect to a desire of appointing one of its country members to be an hon. secretary. I feel sure you will agree with me that its choice could not have been more wisely exercised than in the selection of Dr. C. E. Saunders for this office. I venture to believe that this appoint-

ment will bear good fruit—indeed it has already borne good fruit, inasmuch as we are indebted to Dr. Saunders's zeal for the goodly accession to our numbers promised by the nominations made this evening. I hope, moreover, that the appointment will be everywhere received, as it was intended, as a token of respect for that great body of our members whose work lies beyond the limits of the metropolis, many of whom I trust will have carried home from the Conference a conviction that, though they are but too seldom amongst us, they hold a high place in the esteem of their metropolitan colleagues, upon whom, of necessity, so large a share in the conduct of the business of the Society has hitherto devolved.

In my address last year I dealt with the subject of metropolitan sanitary administration, in view of the introduction of the London Government Bill. My observations were designed to illustrate the need of unity and uniformity in the administration of sanitary law; and in considering the question "*How such unity might be attained*," I pointed out that two courses were open: the existing Local Authorities might be swept away and an entirely new authority created to rule over an undivided metropolis; or, the present local machinery being retained, a central board might be established to take charge of all important matters affecting the metropolis as a whole; to lay down the principles on which sanitary administration should be carried on, by framing bye-laws, etc., and generally to exercise a supervisory control over the work of the vestries and district boards. The Central Board, I said, should be legislative in its functions, the Local Boards executive, and thus substantial unity might be attained with a minimum of change. I expressed my personal preference for the second of these courses, finding it difficult to believe that a system of local government which had worked on the whole very well, and conferred many benefits on the metropolis, should be cast aside in favour of a new, a vast, and a doubtful experiment, such as that involved in the adoption of the first course.

Assuming the probability of this more conservative plan being adopted, I briefly touched upon the constitution, the jurisdiction, and the duties, *quâ* sanitary administration, of the several authorities out of which the new machinery of local government would be evolved:—to wit, the Corporation, the Metropolitan Board of Works, the Vestries and District Boards, and the Metropolitan Asylums Board. The scheme of my preference providing for the retention

of the vestries and district boards in a local executive capacity, subject to such control as might be necessary to secure unity and uniformity, it was with the constitution of the new central authority that I chiefly concerned myself, and I pointed out that the continued separate existence of the Corporation and the Metropolitan Board of Works was incompatible with the formation of such an authority; unless, indeed, the Corporation should be permitted, under some necessarily reformed constitution, to maintain its ancient rule in the City, leaving the rest of the field clear for the Metropolitan Board. Otherwise, the question arose—Shall the Corporation, endowed with enlarged jurisdiction and the necessary powers, become, in fact, as in name, the Corporation of London; or shall the Metropolitan Board, under whatever name, extend its sway over the City? Prescription and historical prestige pleaded for the Corporation, while the success that had attended the work of the Metropolitan Board suggested strong arguments in its favour. Whichever body might be selected, I expressed the opinion that if the members of the central authority could be elected, as the members of the Board now are, by, and practically from, the vestries—themselves immediately representing the ratepayers—London would have a better prospect of being well and wisely governed, than if the members should be elected directly by an appeal to popular suffrages. The latter plan, I feared, might have the effect of making the elections the subject of party warfare, thus depriving the system of local government, as it exists, of the honourable distinction of being of an absolutely non-political character. I proposed to hand over to the new authority, among other duties, those at present discharged by the Metropolitan Asylums Board, so far as they relate to the treatment of infectious diseases, together with the hospitals and ambulances; endowed it with power to acquire on equitable terms the property of the water companies; made it the vaccination authority; clothed it with power to provide baths and wash-houses, and mortuaries; to appoint coroners and registrars of births and deaths, etc.; and assigned to it the provision, or at least, the control, of cemeteries. Only one entirely new department, I said, would have to be created—one, however, of the highest importance, and of special interest to ourselves—that, namely, of Public Health. I assumed that a principal medical officer of health—*primus inter pares*—would take charge of the City, naturally the seat of government, and that all local medical officers would be placed in direct relations with him, so as to secure the unity and uniformity in sanitary and public health administration, so much desiderated.

For the discharge of the multifarious duties that would devolve on the central authority I assumed that it need not be larger than the Corporation, which comprises 232 members—a number that should prove ample, if one may judge from the amount of work got through by the Metropolitan Board with forty-six members, by the School Board with fifty, and by the Asylums Board with sixty. With the above sketch, let me now briefly compare the scheme, mainly as it affects the sanitary question, embodied in the London Government Bill.

It is proposed that the Corporation, endowed with enlarged powers, with substantially its present numbers, but divested of its ancient aldermanic glories, should be the Corporation of a City of London extended so as to include the area under the Metropolitan Board of Works. Notwithstanding its enlargement, it is professedly to remain the same Corporation and to exercise its existing powers and duties. The Metropolitan Board of Works, the Vestries and District Boards, the Burial Boards, and Commissioners for Baths and Wash-houses, become merged in the Corporation, or, in other words, are all swept away, and the powers and duties they have hitherto discharged are to devolve on the Corporation. The Poor-law Authorities—and, therefore, the Asylums Board—are not affected by the Bill.

The enlarged London is divided into "Municipal Districts", which, until altered by "a scheme", are the present administrative areas; but the Corporation has power to unite, divide, create, and alter both municipal districts and their constituent "wards". Each Municipal District is to elect its allotted proportion of Common Councillors, and the several wards are to elect "District Councillors". The District Councillors, together with the Common Councillors of the district, will form a District Council for the Municipal District; and, as the Municipal Districts are the present areas, the District Councils will practically replace the Commissioners of Sewers in the City, and the Vestries and District Boards elsewhere.

Common Councillors are elected by the citizens in the entire Municipal District; District Councillors by the citizens in the several wards—all at the same time. All elected persons serve for three years; the elections, by ballot, being triennial. Of the first Common Councillors, 46 are the present members of the Metropolitan Board of Works, 44 are to be elected by the present Common Council for the City, and the remaining 150 will be elected by the citizens. At the end of three years, the whole body of Common Councillors will be elected by the citizens in the several Municipal Districts.

The first duty of the Common Council will be to determine the powers and duties to be delegated to the District Councils. Each District Council will have such powers and duties only as the Common Council from time to time may assign to it; it will, in fact, exercise and perform such of the powers and duties of the Corporation (except the power to raise money) as the Common Council—on account of the local character of the powers and duties, or on account of local or other special circumstances—think can be more advantageously exercised or performed by a local body. The Common Council will assign officers to each District Council, and regulate the appointment, removal, and payment of such officers. The present officers of the authorities merged in the Corporation of London, become officers of the Corporation, and are to continue to perform their present duties, etc.; but the Common Council has power to distribute the duties among all such officers. Should the District Council make default in the due execution of any of the powers or duties delegated to it in any matter affecting the public health, etc., the Common Council may revoke the said delegation and themselves execute such power or duty, at the cost of the defaulting local body. The Common Council are required to submit Bills to Parliament for transferring to themselves the purchase and regulation of water-works and gas-works, or the provision of a new supply of water, gas, or light. Coroners are to be elected by the Common Council, and to be paid by salary. The Baths and Washhouses Acts may be carried into execution by the Common Council, either themselves or through the District Councils; and the Common Council may, if they think fit, frame "a scheme" for constituting themselves the Burial Board for the whole of London, for the provision and management of burial grounds.

Such, very briefly, are the main provisions of the Bill, so far as they affect the question before us to-night. Whether they would have found favour with Parliament, or either House, it is impossible to say; the House of Commons itself had not an opportunity of expressing any opinion on the subject, the Bill, owing to circumstances to which I need not advert, having been withdrawn before it arrived at the stage of second reading. Apparently, however, the House was not very enthusiastic, while outside there was not that general consensus of public opinion in favour of the Bill, without which so important a measure, touching so many interests, could not have been carried safely through the shoals and quicksands of Committee. The bodies proposed to be merged in the new Common Council were almost unanimously opposed to the measure. The Corporation characterised it as "a Bill of Disturbances",

practically extinguishing that ancient body, with its "charters, liberties, and traditions", while professing its extension and enlargement. The Vestries and District Boards objected that the Bill annihilates the vital principle of local self-government, vesting, as it does, in the proposed Corporation, all the powers and duties relating to local management now exercised by themselves; no sufficient cause, moreover, having been shown for so sweeping a change. Not denying that some alterations and amendments of the existing methods of governing the metropolis might be beneficial, they contended that any shortcomings in their administration had arisen from want of power under the laws they had to administer, rather than from any action, or want of action, on their part; they maintained that the Bill should have clearly defined the powers, duties, etc., to be conferred, and the liabilities to be cast, on the new or substituted authorities, so that an opinion might be formed of the sufficiency and capability of these bodies to undertake the work; they objected to the incompleteness of the Bill, which places so much power in the Common Council, and leaves practically none to the District Councils, whose position would be subservient, their powers being wholly of a delegated character, to be defined by "district orders", and to be subject to veto, reinforced in certain cases by coercion.

Such, *in limine*, are the views of many of the constituted authorities outside the City who are practically unanimous in desiring to have a perfect scheme settled by the Legislature itself, and not dependent on the will of a Central Authority; a scheme which should secure to every district the exercise of local self-government by a representative body chosen directly by the ratepayers, and subject only to the control necessary to ensure a proper discharge of its statutory powers and duties.

The Society, abstaining from any expression of opinion on the Bill generally, was yet able to recognise in its provisions a prospect of attaining unity and uniformity in sanitary administration, and a resolution to this effect, unanimously adopted and forwarded to the Home Secretary, was received very graciously, and quoted in the House with evident satisfaction.

The Bill presents many points of resemblance to the scheme I ventured to suggest last year, and being capable of amendment in Committee, I cannot consistently enlist myself in the ranks of its opponents. But it falls short in one important particular of my conception of what a London Government Bill should be, inasmuch as it makes no provision for enabling the Common Council, the supreme sanitary authority, to transfer to itself the powers and duties

now exercised and performed by the Asylums Board with respect to infectious diseases. The provision of hospitals and ambulances should be in the hands of the Central Board, and this is the more necessary now that the relief afforded to the sick in the hospitals of the Asylums Board, a branch of poor-law administration, no longer carries with it any taint of pauperism.

It is questionable whether any concessions by the Government, or any alterations likely to be sanctioned by Parliament, will suffice to remove the objections entertained by the City Fathers, who appear to have taken up a position of unqualified hostility against the Bill. They will have none of it. They disregard the promise of increased power and dignity which it speciously offers, for they know very well that the Corporation of the enlarged City of London would be an entirely new creation. Hostility with them, therefore, is simply an instinct of self-preservation.

Were the Bill so amended in Committee as to be rendered generally acceptable to the ratepayers and their representatives, outside the City, the opposition of the Corporation might, and probably would, be overborne. In any case, however, it is certain that the opposition of the City will be a very serious matter. It is worth considering, therefore, whether it might not be well, if only out of regard for the historical past, to leave the Corporation alone; or, as I have already suggested, suffer it, under some reformed constitution, to maintain its ancient rule within the bounds of the City?

Such a course would not prevent, nay, it would smooth the way for, reform, and that in a manner agreeable to our insular conservatism, which, in schemes of this nature, takes pleasure in building on the foundation of existing institutions. The Vestries and District Boards cannot be said to have come badly out of the trial to which they have been subjected during the last few months. Indeed, I am disposed to think they have risen in public estimation, as their character and their work have become better known, as a result of the enquiry and discussion to which the introduction of the Bill gave occasion.

Should it, therefore, be found impracticable so to alter and amend the measure as to secure its adoption by Parliament, the Government need not abandon their self-appointed task of reformation, it being in their power to create a good practical scheme for extra-mural London, by placing the Metropolitan Board of Works in much the same position which the Corporation rejects for itself, and by maintaining the Vestries and District Boards as administrators of local self-government. The Board would require to be strengthened in

point of numbers, and this could be done by giving an increased number of representatives to the several Vestries and District Boards, who might still be the electors; themselves continuing to be appointed by the ratepayers, under such altered conditions as may be found necessary to secure real representation.

But, of course, if it were thought desirable, members of the Metropolitan Board and vestrymen could be elected simultaneously by the ratepayers, just as it is proposed in the Bill to elect Common Councillors and District Councillors: or the members of the Board might be in part elected by the ratepayers, and in part nominated, as at present, by the local authorities. In any case, the representatives of each parish or district should be members, and take an active part in the proceedings, of the several Vestries and District Boards; one of them, annually elected, moreover, might be Chairman. The effect of the present system of election is to secure something like permanence in the *personnel* of the Board, which changes little from year to year. "Once a member, always a member", is a rule to which there are few exceptions. Hence the smoothness with which the business of the Board is conducted; every one of its relatively few members knows his duties, and takes an active share in carrying on the vast and varied work entrusted to its charge, under about one hundred Acts of Parliament. The system of direct election by the ratepayers—I do not know whether I should call them citizens—would lead to some infusion of new blood, and this might be an advantage, as it is pretty certain that men who had done good service would be re-elected; in any case continuity would be preserved through the agency of a very able staff of officers.

But to resume. To the Metropolitan Board, thus enlarged, the sanitary powers and duties of the Asylums Board, together with the hospitals, ambulances, etc., should be transferred; the managers should be *ex-officio* members of the Board for the first three years. The Board should be endowed with authority, enabling it to exercise an effective control over the Vestries and District Boards, so as to secure unity and uniformity in local sanitary administration. But it should be content to exercise control for the common good, and not seek to absorb to itself all power and authority by appointing officers responsible to itself alone, for the discharge of duties which can be so much more efficiently carried out by locally-appointed officers, acting under the immediate supervision of the local authorities.

The local machinery being thus retained, the Board should take charge—as to a large extent it does now—of matters affecting the metropolis as a whole, and should settle the principles of sanitary

administration by framing bye-laws for the guidance of the several Vestries and District Boards. It should be, as it were, the brain of the system acting through the local authorities as its executive. In this way substantial unity might be attained with a minimum of change.

I need not pursue the subject. I have referred to it, indeed, only for the purpose of showing that hope of reform in London government, which almost every one admits to be desirable, if not absolutely necessary, need not be abandoned should the Bill fail to find acceptance with Parliament; and that there is an alternative course presenting comparatively few difficulties, one which would conciliate the favour of existing authorities, in whom the Government Bill finds its chief opponents, and which probably would be found at least as effective for all useful purposes as the more ambitious centralising scheme of the Government.

There is a saying that threatened men live long, and the saying is not inapplicable in the case of threatened public bodies. When the Municipal Corporations Act was passed, London was excluded from its operation; but the framers of the measure doubtless intended to deal with the great and venerable Corporation at an early date. Fifty years have since elapsed, and, though more than one effort has been made to carry out that intention—the Bill of last Session being the most serious and the most comprehensive—the Corporation still exists, and, in the pride and plenitude of its power, presents a bold front to those who would lay profane hands on its old charters, liberties, and traditions; with troops of friends and well-wishers, moreover, whom in a variety of ways it has found means to propitiate.

The Bill, then, may fail to pass, and the Government may not be disposed to take up any other scheme; such, for instance, as I have sketched. Let us, therefore, consider whether it is inevitable, in these circumstances, that London should wait indefinitely for an instalment of reform in its sanitary administration? Let us look at this question from the standpoint of existing law, and try to ascertain whether something may not be done without recourse to Parliament at all? It may be that if existing powers were fully exercised, if reform were begun from within, the necessity for reform from without would turn out to be less urgent than some have been disposed to think.

At the Conference one of the speakers lamented that in London we have no bye-laws, like the model bye-laws of the Local Government Board, giving directions with regard to the construction of drainage, etc.; and I then pointed out that although there were no bye-laws in force, or probably in existence, powers existed under

which bye-laws covering pretty well the whole field of sanitation could be framed, and which, if put into force, would have the effect of promoting, if they did not altogether ensure, under masterful control, much-needed uniformity in sanitary administration. Vestries have no power to make such bye-laws, but the Metropolitan Board of Works only. A consideration of the powers of the Board in this regard, and of the relation in which it stands to the Vestries, etc., almost proves, to my mind, that the framers of the Metropolis Management Acts must have had in view some such scheme of sanitary administration as I have sketched; that is to say, a central authority, legislative in its functions, and local authorities executive, working together for the common good. For what do we read in Section 202 of the Act of 1855? That the Board *may* make bye-laws (*a*) for regulating the plans, level width, surface inclination, and the material of the pavement and roadway of new streets and roads; (*b*) and the plans and levels of sites for building, (*c*) and for regulating the dimensions, form, and mode of construction, and the keeping, cleansing, and repairing of the pipes, drains, and other means of communicating with sewers, and the traps and apparatus connected therewith; for the emptying, cleansing, and closing and filling up of cesspools, and of removing and disposing of refuse. If we turn to Section 138, we find that the Board *shall*, in order to secure the efficient maintenance of the main and general sewerage of the metropolis, make such general or special order as to them may seem proper for the guidance, direction, and control of the Vestries of Parishes, and District Boards, in the levels, construction, alteration, and maintenance and cleansing of sewers in their respective parishes or districts, and for securing the proper connection and intercommunication of the sewers of the several parishes and districts, and their communication with the main sewers vested in the said Metropolitan Board, and generally for the guidance, direction, and control of Vestries and District Boards in the exercise of their powers in relation to sewerage; and all such orders shall be binding upon such Vestries and Boards. Theoretically, what more, what better could be desired? Said I not rightly that pretty well the whole field of sanitary administration was covered by the existing powers?

Now turn for a moment to Section 73, which enables the Vestry, as local authority, to require owners, etc., of houses to construct drains therefrom into the common sewer, not at their own discretion, but subject to conditions, which, among other things, provide for fit and proper sinks, and fit and proper syphoned, or otherwise trapped inlets and outlets for hindering stench therefrom, fit and

proper water-supply . . . . and all other such fit and proper works and arrangements as may appear to the Vestry or Board, or to their officers, requisite to secure the safe and proper working of the drain. It seems reasonable to conclude that this section should be read with Section 202, and that the Vestry should be guided, directed, and controlled in the exercise of its powers by bye-laws framed for the purpose by the Board. But there are no such bye-laws. And so with regard to sewerage. No definite principles appear to have been laid down for the guidance of local authorities. Hence it follows, to cite a single illustration, that one local authority is continually passing plans for pipe-sewers, which obtain the sanction of the Board, while in the next parish, it may be, a pipe-sewer is an almost unheard-of thing; brick barrel-sewers only are acceptable, and these are equally sanctioned by the Board. Comment on such a state of affairs is needless. The comparison between administration as it is and as it might be, could be carried into other branches of local government, which is defective because powers are not used rather than from the want of powers. And can it be doubted that the full exercise of the powers of the Board in this matter of bye-laws, and loyal compliance on the part of the local authorities, would be for the good of the community, by promoting that unity and uniformity in sanitary administration which is desiderated, and the attainment of which may be said to be the *raison d'être* of the London Government Bill?

Having regard to the state of political affairs, it appears highly probable that no opportunity of dealing with Metropolitan Government will be forthcoming in the ensuing year. A time of grace, therefore, is offered, which, if wisely used in efforts to put existing powers into force, might avert the necessity for any material change.

But if the Vestries would prolong their rule, they must prove their utility; and just now more than one opportunity of doing this in a practical way is afforded. For example, the public conscience has been greatly stirred by revelations concerning the dwellings of the poor, as witness the Mansion House Council now dealing with the subject; and, although there may have been a good deal of exaggeration in many of the statements respecting it, and a good deal of injustice in wholesale condemnation of the Vestries, the actual state of affairs is bad enough, and demands such remedy as the law affords, pending fresh legislation, should this be necessary. But is it necessary? That question can hardly be answered in the affirmative at present, nor until a strong effort shall have been made by the several sanitary authorities to improve the dwellings of the poor by putting into

operation the provisions of the Sanitary Acts of 1866 and 1874. I referred to this subject last year, and ventured to say that healthy dwellings for the poor could never in any large degree be secured through the operations of the Artizans' and Labourers' Dwellings Acts, and that we must look to the less showy but more practicable machinery which enables the "Nuisance Authority", with the sanction of the Local Government Board, to make regulations for houses let in lodgings or occupied by members of more than one family. In 1879 the Society prepared model regulations for the guidance of the sanitary authorities, few of which, however, have applied for the necessary powers. But if they sinned by their neglect, they could at least plead that they sinned in good company, the Local Government Board having neglected to exercise its power, conferred in 1874, of declaring the enactment to be in force in any given district. The Board, however, shortly after the delivery of my former address, did its part in the matter by declaring the enactment to be in force in every district of the metropolis where it was not already operative, and by issuing "suggestions for regulations" for the guidance of local authorities. Now, evidence is not wanting that in districts where the enactment has been honestly carried out it has done good; and as it is certain that in many cases compulsion is necessary to make owners of tenement and lodging-houses keep them in proper sanitary condition, it is clearly the duty of the local authorities to make and, having made, loyally to enforce, appropriate regulations. Such regulations might be uniform for the metropolis if we had a central sanitary authority to frame them; but this is said by way of parenthesis. At present, the authorities are under no legal obligation to make regulations, or to enforce them when made. The conduct of each, therefore, in relation to this matter, will not unnaturally be scrutinised closely, and may even come to be regarded in the light of a test of sincerity. It is to be feared, however, that the poor themselves will have to pay—and pay heavily, too, in the shape of increased rent, for whatever improvements may be made in their dwellings as an outcome of the regulations. But this we cannot help. Our duty is clear, and must be done honestly, regardless of consequences. The sections of the Acts are very inadequate, but we cannot doubt that Parliament will be found willing to grant whatever additional powers may be found necessary to improve the housing of the poor, with regard to which, as you are aware, a Royal Commission is now sitting.

It has been suggested that sanitary authorities should have power to erect houses for the poor. The supervision of houses in course of construction, in order to enforce proper sanitary arrangements, would

suffice, probably, for all practical purposes. It is worth mentioning, however, in passing, and as another illustration of latent powers hitherto unused, that sanitary authorities may, under the Labouring Classes Lodging Houses Acts 1851, 1866, and 1867, constitute commissioners for the purpose of providing lodging-houses for the labouring classes; and I do not doubt that sanitary houses might be built so as to pay more than the percentage of interest at which money could be borrowed for the purpose. Schemes of this sort, on a very large scale, are now being carried out by the Corporation of Liverpool.

That Parliament is not unwilling to trust the sanitary authorities may be inferred from the fact of its having recently devolved an important duty on them, and their Medical Officers of Health, under the provisions of the Factory and Workshop Act, 1883, the 17th section of which makes the Vestry the local authority under that Act, so far as relates to cleanliness, ventilation, and other sanitary conditions of bake-houses, by enabling them to enforce certain sections of the Factory and Workshop Act, 1878.

Under the provisions of the Bakehouse Regulation Act, 1863, the Vestry was the local authority: that Act was repealed, and their power taken away by the Act of 1878. Why, or wherefore, I trow not. But it soon became apparent that Factory Inspectors were too few in number to deal with bakehouses which, for want of supervision, speedily fell into bad condition. The fact was obvious, and I believe it was partly upon the recommendation of the Chief Factory Inspector himself, that the Government restored to the Sanitary Authority its rightful position in this matter. The Act is imperfect, but much good may be got out of it, as the Medical Officer of Health holds now much the same position formerly held by the Factory Inspector in regard to bakehouses.

The reform thus happily accomplished was in no slight degree due to the action of the Society, which had been in communication with the Home Secretary and the Local Government Board on the subject. On the passing of the Act, moreover, the Society prepared "Suggestions for Regulations with respect to Bakehouses", and sent them to the Sanitary Authorities. The Factory Acts do not expressly authorise the making of regulations, but it was felt that good might result if Sanitary Authorities would accept the suggestions as a standard by which to be guided, and for the use of their officers in supervising bakehouses. Some of them have done so, and my own Vestry has placed a copy of the regulations in the hands of every baker in the parish.

From the foregoing observations you will have inferred, and

rightly, that I attach considerable importance to bye-laws in sanitary administration. Illustrations of their value are not wanting. The Metropolitan Board, for instance, has done good service by framing bye-laws with respect to the foundations and sites of houses and buildings, under the Building Act of 1878; and under other special Acts it has framed bye-laws which have proved of great utility. Need I do more than refer to the bye-laws for regulating offensive businesses under the provisions of the Slaughter Houses (Metropolis) Act, 1874? The noxious trades regulated by that Act were, to a certain extent, under control by virtue of the 27th Section of the Nuisances Removal Act; but notwithstanding all the efforts of sanitary authorities to prevent nuisances in connection with them, nuisances did arise, and were difficult of prevention. You can all bear testimony to the improvement that has been effected through the legislation of 1874, and to the comparative ease with which nuisance is prevented, now that the businesses must be conducted subject to regulations, breach of which is punishable by an irreducible penalty. An incidental result of the Act has been a great reduction in the number of private slaughter-houses, and the time, we may hope, is not distant when these establishments will give place altogether to public *abattoirs*.

Under the provisions of the Dairies, Cowsheds, and Milkshops Order (1879), the Metropolitan Board exercises powers of a somewhat limited character. Nevertheless, under the regulations framed by the Board, the condition of the dairies and cowsheds has been materially improved. The Society, however, has always felt that the Legislature erred in regard to the Contagious Diseases (Animals) Act and the Slaughter Houses Act, in making the Metropolitan Board sole Local Authority for London outside the City. It recognises the importance of uniformity in the regulations which apply to the entire metropolis, and that uniformity was attainable only on condition that the regulations should be framed by one authority; but it was, and is, felt that the duty of carrying the regulations into effect should have devolved by statute on the Sanitary Authorities, subject, of course, to supervision by the Board.

In the Public Health (Dairies, etc.) Bill of 1883, we were threatened with a repetition of the same legislative error. This Bill, the introduction of which was in a large measure due to the representations of the Society, proposed to transfer the control of cowsheds and dairies from "local authorities", under the Contagious Diseases (Animals) Act, mostly county magistrates, to the Sanitary Authorities; it having been found that the Dairies Order, not being intended for

the suppression of epizootics, but only for the protection of the public health, had been practically ignored in the country districts. But the Bill made an invidious distinction in regard to the metropolis, inasmuch as by its provisions the Metropolitan Board was reconstituted sole "local authority", to the exclusion of the Sanitary Authorities, who everywhere else were designated to that position.

Considering how much Medical Officers of Health generally, and the Society in particular, had done to promote reform in regard not merely to cowsheds and dairies, for the protection of public health, *quâ* milk-supply, but also in regard to slaughter-houses and noxious trades, there was, and is, just cause for complaint at the way in which Metropolitan Medical Officers have been ignored in the Slaughter Houses Act and in the Dairies Bill, which, however, was withdrawn on the last working day of the session, and not re-introduced this year.

I may refer to another set of bye-laws, under which good sanitary work might be done, that known as the "Water Regulations", framed by the Companies in 1872, and approved by the Board of Trade, whose powers, however, under the Water Acts, were subsequently transferred to the Local Government Board. Some of these regulations appear to have been framed in the interests of public health; those, for instance, dealing with the cistern,—which is to be kept water-tight, properly covered, and placed in such a position that it may be inspected and cleansed,—and those forbidding the use of buried cisterns and unlined butts for the storage of water, etc. But the 14th regulation, which provides for the abolition of waste-pipes connected with drains is, perhaps, the most important. Last year, and again this year, the attention of Sanitary Authorities was pointedly called by the Local Government Board to a Memorandum by their Medical Officer, prepared in view of a probable visitation of cholera, in which it was advised that "any connections of waste-pipes of cisterns with drains should be severed". Advantage was taken of the occasion thus afforded to draw the Board's attention to the imperfections of the law, which does not allow Sanitary Authorities to carry into effect the advice of their Medical Officer in the simplest way, viz., by enforcing the 14th regulation.

Request was made to the Board to take steps to secure the suggested severance of waste-pipes by urging the companies to put that regulation into immediate and universal operation, by serving the requisite notice on consumers; and the Board was further requested to consider the desirability of bringing in a Bill to give the Sanitary Authority concurrent power to enforce this and some other of the

regulations. That the companies have grievously failed in their duty to the public by treating this regulation as one for preventing waste of water only is beyond question.

It is satisfactory, however, to note that, the Board having addressed a communication to the companies, they yielded to the representations made to, the extent of agreeing to deliver at every house in the metropolis a circular notice in which attention was drawn to the advice on the subject of cleansing and covering of cisterns, and cutting-off waste-pipes, which, from time to time, over a period of many years, the Water Examiner has embodied in his monthly and annual reports. It is to be regretted that they let slip so fine an opportunity for effecting an important sanitary reform: it would have been to their interest to enforce regulation 14 universally, for many of the complaints of bad water, which arise from time to time to their prejudice, are due to contamination resulting from connections of waste-pipes with drains. Waste-pipes, we are told, will be abolished when constant supply is given, but for this large portions of the metropolis will have to wait a long time. Meanwhile we must rest satisfied with the hope that Sir Francis Bolton's advice will have some effect, there being the prospect that it will reach the consumers, as an abstract of his reports on the subject of deterioration of water in dirty cisterns, etc., is to be printed in future on the back of the companies' call-papers. But nothing short of an epidemic of cholera, I suppose, will suffice to bring about universal compliance with the advice of the Water Examiner in regard to waste-pipes, viz., by the exercise by the Water Companies of their powers under regulation 14, or by co-ordinate power to enforce the regulation being conferred on the Sanitary Authorities. By way of parenthesis I should like to say in passing that the power of Water Companies to cut-off water for non-payment of the rate should be totally abolished.

The Nuisance Authority has power under the Sanitary Act, 1866, to make regulations with respect to the periodical removal of manure; and, as I have already intimated, the Metropolitan Board has power to make bye-laws for "disposing of refuse" generally. These valuable powers should be exercised to the fullest extent. To this end it would be well, if it were possible, to place a limit to the discretionary authority vested in magistrates to reduce or remit the penalties which may be imposed for each breach of the said regulations and bye-laws. The regulations for the periodical removal of manure have fallen into comparative desuetude in my parish, owing to the reluctance of the justices, before whom nuisance and sanitary cases are taken, to inflict adequate penalties.

There are other powers under the Nuisances Removal and Sanitary Acts, to which I might refer did time permit. They are familiar to most of you, and they ought to be well known to the local authorities through the excellent "Digests" of the several Acts prepared and issued by the Local Government Board during the current presidency. When all existing powers shall have been fairly tried and found wanting we may confidently rely on the willingness of the Government, and of Parliament itself, to grant such additional powers as may be proved necessary. Among these we may reasonably include power to the Metropolitan Board to fix sites for mortuaries and disinfecting chambers, and for baths and wash-houses; all of which, being of general requirement, should be provided, not haphazard, but upon a plan so arranged as to supply the needs of the population, irrespective of local boundaries. The Board, moreover, should have the power to which it aspires of settling the Water-Supply question by purchase of the Companies' property on equitable terms.

In course of time the powers of the Asylums Board must necessarily fall into the hands of the Central Authority, and then we may hope for an Act providing for the Notification of Infectious Diseases. Meanwhile, it would be well if some Vestry or District Board should set a good example, by introducing, in a Local Bill, the Sclater-Booth Model Clauses, to secure this valuable power in its own district.

But I must hasten on. Hitherto I have spoken chiefly of sanitary powers. I must not conclude without a reference to sanitary difficulties. These are partly inherent in the law itself, and partly incident to the method of its administration when once this has passed from the sanitary to the judicial authority. There is no power to punish the person who creates a nuisance, however great or long continued it may be, and it takes an inordinate time to get a nuisance abated when the author of it is recalcitrant.

The public, naturally supposing sanitary law to be the embodiment of common sense as applied to matters of public health, are too apt to regard the sanitary authority as all powerful but apathetic, and to lavish blame upon it for not at once abating a nuisance when reported or discovered. But the law is at once too considerate for the rights of property, and too leisurely in its movements, to permit this to be done. The principal offenders, owners of tenement houses, know by experience that they incur little risk by total disregard for a considerable period of the requirements of sanitary notices. There is, as they at any rate well know, no power enabling the Sanitary Authority to bring about a speedy abatement of nuisances if the

nuisance-maker thinks fit to resist. What is the course of procedure in such a case? Notice of the nuisance must be given by a duly-appointed officer to the nuisance authority, whenever it may happen to meet, and such notice as it may direct is then served upon the person by whose act or default the nuisance is caused. Time has, of course, to be allowed for the abatement of the nuisance. If the terms of the notice are not complied with, a summons may be taken out. This is rarely made returnable in less than a week. The hearing, moreover, may be postponed owing to press of other business, or it may be adjourned. But should the case be clear, and get decided without delay, the magistrate can only make an "order" for such work to be done as he shall consider necessary for the abatement of the nuisance: his powers, however, are very considerable in this regard. Usually, of course, the order runs on all fours with the previous notice. After the order has been prepared and signed by the magistrate it must be served. Ample time is allowed—too much time often—for carrying out the terms of the order, and it is only after the lapse of such time that, in case of disobedience, penalties begin to accrue at the rate of not more than ten shillings *per diem* from the date of service of the order. The issue of a summons for penalties probably rouses the defendant to the necessity of action, and generally before the hearing (that is, within seven days) the necessary work will have been done, and the nuisance abated. The judicial authority is thus propitiated—supposing the sanitary authority thinks it worth while going into court to press for penalties; and either the offender is let off entirely, or, as often happens, the diurnal penalty inflicted is nominal. The proceedings by this time will have lasted for weeks—often for many weeks—and meanwhile the wretched inmates of the house may have been suffering in health and comfort without remedy. Nay, more, they will think themselves fortunate if they are not made to pay an increased rent to compensate their aggrieved landlord for the trouble and expense to which he has been put. All this is bad enough, but in an extreme case the Fabian tactics are not yet exhausted. Notice of appeal may be given. Weeks, months, may elapse before the appeal can be heard, the nuisance continuing unabated. Prior to the hearing, the work is done; the appeal is withdrawn, and, *causa finita est!* This is no imaginary picture. I am describing what has quite recently occurred within my own experience, and what is probably familiar to most of you.

Defects in drainage, etc., may be remedied under the Metropolis Management Act; for, of course, you are aware the proceedings above

sketched were taken under the Nuisances Removal Acts. The Vestry may serve a notice on the owner, and if the requirements of the notice are not satisfied within the allowed time, it may enter upon the premises and do the necessary work at the cost of the owner. This course, however, is seldom adopted, owing to the practical difficulty of recovering the costs. If penalties are incurred under this Act, they may be reduced or remitted by the magistrate: proceedings, therefore, are usually taken under the Nuisances Removal Acts. The remedy for the intolerable state of things described is, I think, simple. The justices should have power by their order, when they see fit, to inflict a substantial penalty upon the person by whom the nuisance is caused: this power is possessed by extra-metropolitan justices under Section 96 of the Public Health Act (1875), the maximum penalty being five pounds. At the hearing, all circumstances aggravating the original offence should be placed before the court, and the person who has disobeyed the nuisance authority's notice, ought to be able to make out a good case, in order to escape infliction of a penalty proportioned to the gravity of the offence. I am not sure but that we ought to be able to go even further than this, and that when the nuisance is not abated within the time limited by the Vestry's notice, and has been certified by the Medical Officer of Health to be dangerous to health, the Vestry should be required to enter upon the premises and abate the nuisance at the cost of the person liable.

If such powers were conferred upon magistrates and sanitary authorities their work would be lightened and made easy. It would seldom be necessary to put the powers into operation. Law-breakers would soon discover that their tricks of delay and resistance were alike useless and unprofitable, and in the result all reasonable notices of the sanitary authority would be respected and obeyed.

Reference may be made, in conclusion, to cases that have come before the courts, and which promise to be of great importance as precedents, in a public health point of view: cases, I mean, in which tenants of insanitary houses have proceeded against their landlords to recover damages for injury to health resulting from drainage and other structural defects. Decisions in several cases have been given in favour of the tenant, and it may be hoped that in course of time bad landlords will find out that it is dangerous, in more senses than one, to let an insanitary house. The legal maxim, *caveat emptor*, cannot equitably apply in such a case. There should be an implied warranty, when a house is let, that it is in a proper sanitary condition, that it is fit to live in; and before long I hope this will be established as a principle of English law.

ON THE SUPERVISION OF OFFENSIVE TRADES IN THE METROPOLIS.

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THE few days which have elapsed since it was intimated to me that the Society desired a paper on the subject of offensive trades, for reading at to-night's meeting, have unfortunately been trenched upon by illness, and the time I have been able to give to the preparation of this paper has, therefore, been too short for anything like exhaustive treatment. In addition to dealing with the subject more thoroughly, I should, if time had allowed, have had prepared some plans and diagrams illustrative of methods for preventing nuisance, which, I fear, may be hardly intelligible without such illustrations: so that, in their absence, I propose to avoid technical details as far as possible, and to confine myself to a few brief notes on those points in connection with the subject, the discussion of which will, I think, be of most interest to the members of the Society.

The diminution and prevention of nuisances arising in trade processes, are objects which have always demanded the attention of sanitary reformers, and, in recent years, from a variety of causes, the necessity for such attention has undoubtedly increased. Science has, from time to time, revealed the commercial value of much that was formerly looked upon as waste or refuse, and in utilising such refuse many new processes have been developed, which have increased the number and variety of the effluvium nuisances from offensive trades. I do not think there is now much difference of opinion on the general question of the necessity for regulating such trades, to the extent at least of requiring the observance of reasonable precautions for preventing public nuisance in carrying them on, and the tendency of modern legislation has certainly been to attain that object, by subjecting such trades to regulation and official supervision. Only some classes of offensive businesses have, however, been so dealt with, whilst other classes of trades, productive probably of quite as much nuisance, have been allowed to remain without interference. The anomalous

state of the law on this subject is difficult to understand, and, if it can be shown that the result of the supervision given to those nuisance trades which have been regulated by statute has been beneficial to the public and not injurious to the trades, it may, I think, be fairly inferred that the extension of such supervision to other offensive trades will also be of public advantage.

I will, therefore, endeavour shortly to describe, in illustration of this proposition, what legislation and supervision have done towards protecting the public from nuisance arising in some classes of offensive trades carried on in the metropolis; and, then, to briefly indicate some industrial operations causing nuisance which are not under legislative restrictions.

Modern legislation on this subject may, so far as London is concerned, be said to have commenced with the Metropolitan Building Act of 1844. Section 55 of that Act provided, with regard to the businesses of a blood boiler, bone boiler, fellmonger, soap boiler, tallow melter, tripe boiler, slaughterer of cattle, sheep, or horses, *and any other like business offensive or noxious*, that it should be unlawful (1) hereafter to erect any dwelling within fifty feet of a building used for any of the specified businesses; (2) To establish or newly carry on any such business, either in a building, in a vault, or in the open air at a less distance than forty feet from any public way or fifty feet from a dwelling; and (3) That if any such business be *now* carried on within the distances prescribed in the last paragraph, then, from the expiration of the period of thirty years, it shall cease to be lawful to carry on such business in such situation, *save as hereinafter provided.* It is necessary to indicate, as clearly as their great complexity will admit, what the scope of this and of the following sections really was, as some amount of misapprehension exists on the subject. Indeed, it is very generally thought that if these sections had not been repealed, or partially repealed, by the Slaughterhouse, etc. (Metropolis) Act, 1874, the whole of the slaughterhouses and other specified offensive trades that were within fifty feet of a dwelling or forty feet of a highway, would have been abolished at the expiration of the thirty years provided for in the Act of 1844. A careful examination of the 56th and following sections of that Act will, however, show that such a result would not, by any means, have necessarily followed if the provisions had remained unrepealed.

The 56th section enacts that "notwithstanding the said term of thirty years shall have expired, if any party charged with carrying

on such business show" that all the means then known for mitigating the effect of such business have been adopted, the justices are empowered to mitigate the penalty as they think fit: and the section further provides that where the best means have not been used, the justices may suspend their decision, upon condition that within a reasonable time such better means are adopted as the justices deem fit: and it still further provides that the justices may, "without consulting the prosecutor", make such order touching the carrying on of such business as they think expedient for preventing the nuisance in future. And the 57th and following sections provide for appeals against the justices' decisions, either to quarter sessions or to a jury: and for the removal by way of purchase of offensive businesses on the memorial of two-thirds of the inhabited householders of the parish—the amount of compensation being paid by the memorialists or by a rate on the parish.

It appears probable that if these sections had been allowed to remain wholly unrepealed, very little change would have taken place at the expiration of the thirty years. Looking to the nature of the legal proceedings which must have been instituted in each case—possibly by persons affected by the particular offensive trade, possibly by the vestry of the parish or some other public authority—and looking to the way in which vested interests are guarded by the successive provisions in these sections, I think that all that would have resulted, if they had remained unrepealed in 1874, would have been, not the anticipated abolition of the offensive trades, but the adoption of improved appliances in those few cases where legal proceedings might have been instituted. Those sections are still unrepealed so far as "the business of a bone boiler, blood boiler, and any other like business offensive or noxious" is concerned, and it is open to anyone to test their value; but I may say that the Metropolitan Board of Works have not thought it desirable to take that course.

However, as the expiration of the thirty years of grace provided for in the Building Act approached, the implicated trades grew alarmed, and were successful in obtaining the appointment of a Committee of the House of Commons, in the session of 1873, "to consider the operation of Clauses 55 and 56 of Act 7 and 8 Victoria, cap. 84, and the best means of making provision concerning the offensive and noxious businesses therein specified." That Committee, after taking a great deal of evidence from Medical Officers of Health, from members of the trades, and from other persons (including members of the Committee, who had personally inspected both private and public slaughter-

houses in the metropolis), recommended that "all businesses that may be called noxious, whether enumerated in the Act of 1844 or not mentioned in it . . . should not be actually banished from the metropolis unless a case of nuisance can be established against them, but that they should all be subjected to stringent rules and frequent inspection, and the sections of the Act of 1844 concerning the enumerated trades should be repealed."

The Government of the day took no action on the report of the Committee, but a Bill was introduced by private members in the Session of 1874, embodying the recommendations of the Select Committee, and this Bill became law, as the Slaughterhouses, etc., (Metropolis) Act, 1874. This Act repealed the 55th and 56th sections of the Metropolitan Building Act, 1844, only so far as concerned the business of a soap boiler, tallow melter, knacker, fellmonger, tripe boiler, and slaughterer of cattle. It absolutely prohibited the establishment anew within the metropolis of the business of a blood boiler, bone boiler, manure manufacturer, soap boiler, tallow melter, or knacker, but it permitted the establishment anew of "the business of a fellmonger, slaughterer of cattle, tripe boiler, and any other business which the local authority may declare by Order confirmed by the Local Government Board to be an offensive business," provided the sanction of the local authority had been formally obtained. The Act also provided for the making of bye-laws for regulating the conduct of the specified businesses, and the structure of the premises on which such businesses are carried on.

There were, at the time this Act passed, about 1,429 licensed slaughterhouses in the metropolis, and perhaps rather more than 200 premises upon which the other businesses named in the Act were carried on. The latter number has since increased, not in consequence of new businesses having been established, but because of the additional businesses which the local authority has since declared to be offensive.

All the trades named in the Act, with one exception, arise out of the slaughtering of animals; in other words, they are trades in which the skin, bones, blood, fat, and offal of animals are utilised; and this is important in connection with the limitation which it imposes on the local authority in declaring other businesses to be offensive businesses within the meaning of the Act. For it is now well established in law, that any businesses dealt with under a statute, must be *ejusdem generis* with the businesses actually named in such statute. The business of a "manure manu-

facturer" is, however, also specified in Section 2 of the Act, and although there may be manure manufacturers who exclusively treat animal matter, that is not usually the case.

Beginning with slaughterhouses, the local authority made a set of bye-laws which deal with the sanitary conditions affecting such places, and these bye-laws have proved adequate to their purpose, although they are open to criticism, and could be improved. The Board's early experience of slaughterhouses only partially confirms the view of the Select Committee, that the private London slaughterhouses are well kept, as it was found that that was true of only a small proportion of the whole. In a few districts where the local sanitary authorities had paid special attention to the condition of these places, and had exercised the power given them by the 93rd section of the Metropolis Management Amendment Act, of objecting before the licensing justices at the Annual Special Sessions to the renewal of the licenses, the condition of the slaughterhouses was found to be good. But over the great bulk of the private slaughterhouses no effectual supervision appears to have been exercised, and their condition emphatically proved the necessity for uniform and persistent supervision. The worst premises, to the number of 620, have now been abolished, and of those remaining it can be said that although many are, as to situation and structure, unsuitable, few or none are a cause of public nuisance, or even of inconvenience.

I do not remember more than one complaint having been made against private slaughterhouses to the local authority during the past year, and although the absence of complaint is no sure indication of the absence of nuisance, it in this case confirms the observation of the officers of the Board.

The chief groups of premises in which are conducted other offensive businesses dealing with animal substances are in Bermondsey (where leather tanning, fellmongering, glue and size making, and other such trades are carried on), and at Belle Isle, Islington, at Southwark, and at one or two other points, but isolated businesses of this nature are distributed in nearly all parts of London.

I need hardly point out that suitableness of situation is one of the most important considerations in dealing with offensive trades, or that it would be desirable, if it were possible, that all such trades should be confined to certain specially suitable localities. It may be urged, indeed, that the accumulation of a number of industrial nuisances in one place would have the effect of making that place unwholesome and quite unfit for residential purposes; but that would

certainly not be the case if the trades were properly conducted, as all that could then arise would be those occasional accidental discharges of effluvia which it appears almost impracticable to prevent entirely. Such an occasional temporary discharge would hardly be noticed in neighbourhoods where many offensive trades were carried on, but might be a source of serious annoyance in a good residential district ; and I may incidentally remark that one of the most troublesome matters in connection with an offensive business carried on in such a district is, that every nuisance experienced in the district is put down to it.

The second set of bye-laws framed by the local authority under the Act of 1874, deals with the businesses of a blood boiler, bone boiler, manure manufacturer, soap boiler, and tallow melter. This set differs from the other bye-laws made under the Act, in not attempting to deal with the conduct of the businesses in detail; but provision is made in general terms for the storage of offensive material and the conduct of offensive processes in such a way that no effluvia shall escape into the external atmosphere.

As the trades in this group are mostly conducted on a tolerably large scale, and have been in the past productive of much nuisance, I will briefly describe the measures taken for minimising their offensiveness.

The first in the group is the business of a blood boiler, but the process of blood boiling is almost obsolete, having been superseded by better methods. The old process of blood boiling was a most offensive one, consisting as it did in the elimination of moisture from the blood by means of dry heat. At only one establishment was this process found to be carried on in London, and the remedy for the great nuisance that arose was found in the abolition of the process. This was, however, only effected after legal proceedings had been taken and penalties imposed. Blood boiling may still be carried on in a few places outside the metropolis, and should nuisance be experienced from the process (which would certainly be the case if the works were near inhabited houses), I should recommend that an endeavour should be made to induce the proprietor to adopt a more economical and less offensive method.

The process of bone boiling is a more difficult one to deal with. The business of a bone boiler consists in the collection of both fresh and stale bones from slaughterhouses, butchers' shops, marine store dealers, and other places. These bones are first sorted, and those which are suitable for ultimate use in manufacturing purposes are sawn, usually

by steam saws. The remainder are passed through a crushing mill, and are then boiled for the purpose of extracting from them the fatty matter, which is valuable for soap making and other purposes. The boiling is usually effected by free steam, that is, by the injection of steam into the boiling pans ; but it is sometimes accomplished by boiling in water by means of a fire underneath each pan. When the process of boiling is completed, the fat is removed from the pans, the water run off, and the bones removed to a storage place called the "bone hole", where they accumulate until removed in bulk for use as manure or in manure making. The nuisances arising in this business are from the accumulation in large quantities of bones that are not always fresh, and from the effluvium that comes from the boiling pans, but probably the greatest amount of effluvium arises from the heating of the decaying bones in the bone hole. This gives rise to fatty ammoniacal odours of an intensely disagreeable nature, which in certain states of the atmosphere will extend to a great distance from the premises ; and it is not too much to say that a badly conducted bone-boiling business is an intolerable nuisance to the neighbourhood in which it is carried on. If model premises with the best appliances could be erected in a suitable neighbourhood, this business could, I have no doubt, be carried on quite without public nuisance ; but in London such conditions do not exist, and I think the Legislature were well-advised in omitting this business from the repealing section of the Act of 1874. For the reasons which I have already explained, the sections of the Building Act of 1844, still in force as far as this business is concerned, were inoperative in effecting its abolition from the metropolis, although in very few cases were the premises at the prescribed distances from public highways or inhabited houses. The Board were advised that it would be a good defence if a bone boiler could show that he had adopted the best known means for preventing nuisance from his business, and they came to the conclusion that they could obtain the adoption of such means more readily and economically by making and enforcing bye-laws than by taking legal proceedings in the superior courts for enforcing the old sections.

That the Board have not been successful in entirely preventing nuisance from this trade is due chiefly to the fact that most of the premises in which it is carried on are old and unsuitable, and also to the fact that the premises are in some of the most thickly populated districts in London. One of the most effectual means for preventing nuisance from this business is, where the construction and arrangement of the buildings admit of it, to make the whole premises a

series of close chambers, the outer one alone communicating with the external atmosphere, and then only by one opening on the ground level. This opening serves the double purpose of an air inlet and an entrance gateway. In the outer chamber carts can be loaded or unloaded, bones sorted, sawn or crushed, and, if necessary, the boiling pans (usually on a raised stage) can also be placed. The effluvia arising in this chamber can be disposed of and the place ventilated, by the air being constantly drawn through it into an inner close chamber. The effluvia from the boiling-pans should not, however, be allowed to escape into the chamber, but should be drawn off from steam chests at the back of the covered boiling pans, condensed, and then discharged through pipes into the enclosed ash-pit under a furnace fire. In passing through this fire the organic vapours would be burnt. The inner close chamber should be very solidly constructed, of concrete, if possible, but if of brick-work it should be thickly lined or coated with cement. This mode of construction is necessary, as the chamber is used for the storage of bones, the moist, pungent effluvium from which will otherwise gradually permeate the walls and thus cause external nuisance. This inner chamber should be ventilated by means of an air-shaft of sufficient dimensions leading into a condenser and then into a furnace. It will, I think, be obvious that, where the arrangement and construction of the buildings are good, where the motive power used is sufficient for ensuring that the air is always drawn into and never leaves the building except by means of the exhaust shaft, and where the processes of condensation and combustion are properly carried out, nuisance from this business is hardly possible. There are effectual methods of treating bones and of preventing nuisance other than that just mentioned; but I have described this method rather fully, because it has been applied with success to a variety of other businesses.

The business of a manure manufacturer was neither named in the Act of 1844, nor in the repealing section of the Act of 1874. It is, however, one of the businesses which are prohibited from being established anew in the metropolis, by the 2nd section of the last-named statute. There is no definition of "manure manufacturer" in the Act, and the local authority has enforced bye-laws in all cases where manure is manufactured for sale. By manufactured, I mean any trade process, such as mixing; and no attempt to apply the Act has, of course, taken place in cases where stable or other refuse is merely collected and sold as manure. The term, manure manufacturer, is, however, of wide range as practically applied in the metropolis, and includes on the one hand

the collector of refuse fish and fish offal, who at once mixes his materials with such substances as sumach, seal dust, or other absorbent, and sells the mixture as fish manure; and on the other hand includes the large manure works (chiefly on the banks of the Thames), where super-phosphates and other artificial or "chemical" manures are made on a large scale in extensive premises. These latter works are included in the Alkali, etc., Works Regulation Act, 1881; but they were nevertheless under the operation of the Board's bye-laws for some years before that Act came into force, and large sums were spent in making extensive alterations, in order to bring the works into compliance with the bye-laws.

It will be impossible within the compass of this paper to describe, even briefly, the processes of the various nuisance trades which have been dealt with in London, and that is, perhaps, unnecessary, as they are more or less known to you; but I may say that the effluvia from artificial manure making are distinct in character from any arising in the other regulated trades, being chiefly evolved in the mixture of sulphuric acid with coprolites and other mineral phosphates. The fumes from this process are pungent, irritant, and most offensive, and they extend to a great distance from the works: in some places, and in certain conditions of the atmosphere, for upwards of a mile. It was found that most of the firms carrying on this business in the metropolis had not studied the manufacture from a nuisance-preventing point of view, and as the subject involved much technical detail, it proved convenient to prepare a set of suggestions for the prevention of nuisance in the manufacture, with drawings of appliances. I believe these suggestions and drawings proved useful beyond the limits of the metropolis, as the Artificial Manure Manufacturers' Association caused them to be printed and supplied to their members in various parts of the kingdom. In the London works great improvement has taken place, and I do not think that any complaint has been made of them for some years past, either by the public or by the Board's Inspectors.

Of the business of a soap boiler, it is only necessary to say that improved trade processes have so altered the character of soap boiling, that it can hardly be now considered an offensive trade. Where, however, tallow or stuff melting is carried on in addition to soap boiling, as is usually the case, very great nuisance may arise. Stuff melting is the liquefaction, usually by free steam, of the refuse fat collected by marine store dealers and others; and, as this material is always in a more or less decomposed condition, the melting of it will

prove offensive unless the effluvia are collected, carefully washed in a scrubber, and then passed through a furnace. Very great care is also necessary in the storage of the material, in the disposal of the residue, and in the conduct of the business generally. The same may be said of tallow melting, which is a most offensive process when improperly carried on. Tallow melters' premises are in many parts of the metropolis, and, in the past, were constant sources of annoyance; but, since the act of '74 came into operation, gradual improvement has been made in the methods of dealing with the raw fat, in collecting and destroying the effluvia from the melting and pressing, and from the premises generally. Although very large sums of money have been spent in improving many of the London tallow-melting establishments, I do not think there is one that I should like to hold up as a model. Complaints of nuisance, in connection with this trade, have, however, now become rare; but I trust that improvement will still go on until the very best methods only are in use. These remarks also apply to the trades of knacker and tripe boiler, which were formerly sources of much trouble, but which are now usually conducted with care. The only remaining business mentioned in the Act of '74 is that of fellmonger, which is wholly confined to the district of Bermondsey, and is the source of so little nuisance that no bye-laws have been made for regulating it, although a general supervision has been exercised over the works.

The additional businesses, in which animal matter is the chief material used, which have been brought under the operation of this Act by orders of the local authority declaring such businesses to be offensive, are—blood drying, glue and size making, fat melting and extracting, gut scraping, and the business of a gut manufacturer. Most of those trades are probably well known to you, and it will be unnecessary for me to attempt to describe them or the bye-laws made for regulating each business. There are other trades usually considered to be nuisance trades which are carried on in one district of the metropolis, but with which the Board have considered it unnecessary to deal. I refer to the businesses of tanner and leather dresser, which, although not named in the Act, are *ejusdem generis* with the trades that are named. Complaints have never been made of these trades, and as they are carried on entirely in Bermondsey (which is closely identified with them), it is doubtful if they can be said to cause a nuisance to the locality.

In endeavouring to improve the methods of preventing the escape of effluvia in carrying on nuisance trades, the first difficulty usually

met with by a local authority is inability on the part of the trader to see the necessity for improvement. He usually holds strenuously to the view that his particular business is not only not offensive, but that it is positively healthy; and he infers that the neighbourhood ought to be rather grateful to him for carrying it on there than otherwise. He will be sure to refer to the length of time, probably over fifty years, that one or more of his men have been employed at the work, and will instance the general healthiness of the workmen as evidence of its salubrity. Having met this argument as best it is able, the local authority will have to overcome a matter of far greater difficulty—the almost invariable ignorance of the owner of the best methods of preventing nuisance. An officer charged with the supervision of an offensive trade will, in my opinion, be able to do little effective work in improving the way in which that trade is conducted until he has obtained a tolerably exact knowledge of its conditions, and especially of the various nuisance-preventing methods adopted elsewhere. To obtain real and permanent improvement, he must be able to give good practical advice; but in doing this he must always protect himself by carefully enforcing the fact, that the person carrying on the business is responsible to the law, and that although he may act upon the advice given, he will not by so doing be relieved of that responsibility. In very few cases will it be found possible to obtain great changes at once. The educating effect of improvement, however, soon begins to tell, and it must be a very bad case indeed if a manufacturer takes no pride and credit for the perhaps small improvements he at first makes. When he does begin to feel such a pride it becomes possible to induce him to make greater changes, unless, indeed, he is prevented by want of means. Fortunately, economy is on the side of improvement, and after a time the manufacturer begins to see that his alterations have prevented waste, and will probably pay. When that is the case the inspector's work is made comparatively easy. Additional suggestions are readily acted upon, and the manufacturer cordially assists in making his workmen properly use the appliances. Something of this sort has been going on in the metropolis. The persons carrying on offensive trades have been gradually made to improve their processes, and thereby to greatly diminish nuisance; and where it has been possible, they have done this in a way that has paid them. But it is not enough to have the manufacturer on the side of improvement: some advantage must always, if possible, be also given to the workmen, as otherwise they will have no induce-

ment but fear to keep them up to the constant use of the appliances. This lack of sufficient inducement to the workmen is one of the great practical difficulties in the supervision of offensive trades, and it is a difficulty which lasts, as the temptation to shirk what may be a troublesome precaution is always more or less present, while the master or the inspector may be only occasionally on the premises. There is the further difficulty that a manufacturer may be induced to avoid the expense of using the sufficient additional fuel or water necessary in burning or condensing offensive gases. Although there has been often greater comfort to the workmen, and sometimes economy to the master, in adopting improved methods, that is not always the case, and until it is, the most effectual remedy is vigilant and persistent supervision. The qualifications necessary for effectual supervision are high ones; for, in addition to being able to acquire the special knowledge necessary for understanding the working of the regulated trades, an inspector must possess great rectitude, energy, persistence, and tact. If with these qualifications he unites firmness and a kindly manner, he may, and in time does, exert a most salutary influence on both masters and men, who will look with pleasure to his visits, and take a pride in satisfying his requirements.

The times of inspection must be well arranged: they should be at unusual intervals and at all hours. Indeed, night and Sunday inspections have been frequently found necessary in the metropolis. I need hardly insist on the almost obvious fact, that to do effectual work an inspector must be thoroughly impartial and absolutely free from local or other influence.

I also regard uniformity in administration as of utmost importance, and the difficulties in attaining this where a number of inspectors are employed will be readily admitted by those engaged in work of this nature. The method adopted in the metropolis is for the officials to meet weekly to take instructions and to compare notes. This method ensures that the instructions are uniform, and that the experience of each officer benefits the whole.

Notwithstanding all the care a local authority may exercise, complaints will now and then be made, and in investigating them no trouble should be spared, because they indicate weakness of supervision.

Whenever complaint is made of nuisance from works which are under supervision, it is desirable that judicious inquiry should be made of disinterested persons in the neighbourhood of the implicated works; special observation should be kept thereon, and

the arrangements for preventing nuisance should be carefully re-examined. The difficulty that a local authority experiences in tracing the source of a nuisance, which is, perhaps, only at times noticeable, is sometimes very great indeed: and several such inquiries, undertaken by the Board during the present year, have terminated unsatisfactorily, the chief reason being the reluctance of householders to give information, and their apparent inability to take precise observations and notes as to the nuisance of which they complain.

Although the conduct of those offensive businesses carried on in the metropolis, which are now under statutory regulation and supervision, cannot be said to be entirely satisfactory, it can, I think, fairly be claimed in respect of them that marked improvement has taken place. In fact, in his very comprehensive and interesting inaugural address at the last meeting, the President said that you could all bear testimony to the improvement that has been effected under the legislature of 1874, and to that I need only add the expression of my hope that, on the whole, the resulting public benefit has amply justified the special legislation on the subject.

I pass now to nuisance trades dealing with mineral or vegetable substances, but to these I can only briefly refer.

It will doubtless be in the recollection of members that a Royal Commission on noxious vapours was appointed, and took evidence during 1876 and 1877. The Metropolitan Board of Works gave evidence before the Commission as to trade nuisances in the metropolis, other than those with which they had power to deal, and urged that such trades should be brought under regulation.

No practical result appears to have immediately followed from the labours of the Commission, but in 1881 the Alkali, etc., Works Regulation Act was passed. This Act does not deal with the greater part of the trades as to which the Board had given evidence before the Royal Commission, but it includes within its operations Sulphuric acid works, Gas liquor works, Nitric acid works, Sulphate of muriate of ammonia works, some of which are carried on in London. I do not know whether any benefit to the metropolis has resulted from the passing of this Act, as its administration is entirely in the hands of inspectors appointed by the Local Government Board.

There are, however, other trade processes carried on in London which are productive of great and widespread nuisance, such as brick and ballast burning, cement making, tar distilling, iron galvanizing, the salt glazing processes at potteries, paper making, india

rubber making, palm oil bleaching, varnish making, and many other trades. These are all very ably and very minutely described in Dr. Ballard's "Reports to the Local Government Board on Effluvium Nuisances—arising in connection with various manufacturing and other branches of industry"; many of them are probably well known to the members of the Society, and I need only specially mention the process of brick burning and ballast burning. Of the horribly offensive nature of the nuisance from these sources, I need hardly speak, for it is notorious ; and few parts of London, and especially of the suburbs, have escaped it.

The nuisances consist in the pungent and irritating emanations, mostly also of a putrid character, which are given off in immense volume during the processes. This putridity is frequently the cause of the effluvia being mistaken for sewer gases, especially as such effluvia, in some atmospheric conditions, are carried over a considerable area, extending, in several instances, within my own experience, for nearly a mile from the place of burning. It is unnecessary for me to go into the causes of the intolerable nuisances arising in these processes, as now carried on in London and its suburbs, beyond mentioning that the worst of them are probably caused by the use of improper materials for combustion, and that the whole, or nearly the whole, of the nuisances would cease, if proper methods were adopted and proper materials used. There would be no hardship whatever in placing such processes as these, when carried on in, or close to, towns, under regulation and supervision ; and if this were done, the metropolis, at any rate, would be relieved of an intolerable and unnecessary source of nuisance.

In concluding this paper, I may, perhaps, fitly refer to a book called *Municipal London*, by Mr. Firth, the member for Chelsea. In this book, Mr. Firth describes London of the past and of the present, and he sketches what the London of the future should be under a reformed municipal government. In this sketch he urges that a well-trained and intelligent inspector should be appointed for each of the districts into which the metropolis should be divided ; that the inspector ought to report monthly with respect to every noxious trade in his district ; that printed notices should be sent to those persons infringing the law; and that, if, upon the receipt of the next monthly report, the same breaches of the law were reported as still continuing, penal measures should be taken against the offenders. Mr. Firth goes on to say that under this system the condition of every noxious trade, slaughterhouse, etc., throughout the whole of London, could be ascertained without any difficulty.

I fancy if the London of to-day were to be left for monthly intervals between the discovery of offences against its regulations and the enforcement of penalties, it would be in a very much worse state than it is. At any rate, it can be claimed that what Mr. Firth says should be done for London in this respect is already done, and that very much more than he suggests is done ; and I think I can undertake to satisfy him, or any other person who will take the trouble to make the inquiry, not only as to the condition of any premises upon which a regulated offensive trade is carried on in London at the present time, but also as to its condition at any period during the past eight or nine years.

Discussion.

The President, Dr. Orme Dudfield, in moving a vote of thanks to Mr. Spencer for his interesting paper, said he would be glad to be informed whether it was really practicable to so destroy the vapours of organic matters in an offensive state by fire, that no unpleasant smell could possibly escape by the chimney-shaft? He cited a case, within Mr. Spencer's knowledge, which seemed to cast a doubt upon the point. He was glad to hear that there was a probability of improvement in the method of collecting and removing fish offal and similar matters, as the present system was attended with nuisance. Referring to the trades not regulated, he said it was desirable something should be done to diminish the annoyance caused by the usual system of burning bricks, which gave rise to offensive effluvia over large portions of the metropolis during the brickmaking season. He noted that the most offensive features of the trade of a bone-boiler arose from the practice of storing the bones, after boiling, in the "bonehole". This was no part of the "process" of the business, but the nuisance was analogous to that created by the storage of bones and other matters of animal origin on the premises of marine store dealers—a trade which was just as offensive in practice as any of the regulated businesses, and one which he was of opinion should be dealt with under the Act, so as to insure proper control by the officers of the sanitary authorities. He was able to concur, from personal experience, with the statement that "stuff-melting" was a trade from which nuisance was very likely to arise, and often did arise, at the present time. This was due largely to the fact that the "stuff" went to the melter in an offensive condition from the collecting shops—in

other words, from the marine stores. He agreed with Mr. Spencer that great care was necessary in the storage of the material. Mr. Spencer referred only to the premises of the melter; the same care was, however, also necessary at the marine stores, but under the provisions of the Nuisances Removal Acts could not be secured.

Dr. ROGERS said that in the East of London several manufactures were carried on of a more or less offensive character; that he had had some experience of the nuisance produced by blood-boiling, and that at the present time a considerable nuisance was caused in Shadwell by the process of bone-burning; and so offensive is this process that it might certainly have been included in the list of offensive trades dealt with by the Metropolitan Board of Works.

Dr. C. E. SAUNDERS referred to a very common nuisance, which had not been mentioned by Mr. Spencer. He alluded to the effluvium from fish-frying. He believed this was due to the very inferior quality of the oil which was used, and to certain structural defects in the houses in which the business was carried on. A difficulty in applying a remedy seemed to be due to the fact that it was necessary to have frequent access to the fat-pans, and that any kind of "hood" which had been designed to keep the vapours confined failed on this account. He would be glad to hear any practical suggestion from Mr. Spencer. He also confirmed what had been said as to the nuisance from fish and poultry offal. This was taken to the outskirts of London, there sorted, to extract such of the material as was good for pigs' food, or for the use of size-makers, etc.; and the rest was used as manure on the fields, causing a great nuisance, and one lasting for a considerable time.

Mr. SHIRLEY MURPHY referred to the nuisance caused by brick-burning when bricks were burnt in clamps and the out-puts of dust-bins used, and to the comparative absence of nuisance when this operation was conducted in kilns, with small coal for fuel. The Vestry of St. Pancras had, four years before, proceeded against a builder who persisted in burning his bricks in the former method after due notice had been given him by the Vestry. Although the evidence before the magistrate as to injury to health was admitted by him to be proved, he eventually decided in favour of the defendant, evidence having been given that it was the custom of the trade to burn bricks in the manner which was the subject of prosecution. Mr. Murphy argued that if brick-burning were to be permitted in close proximity to inhabited houses, the method adopted should be strictly regulated.

Dr. GWYNN quoted, as showing the necessity for constant supervision and inspection of certain trades, the case of some tripe-dressers at Hampstead, who were carrying on their trade, surreptitiously, in a shed and stable. Offal was thrust down the drains until the public sewer became blocked with a mass of putrid and horribly offensive entrails. The result was a serious and dangerous nuisance. With regard to brickfields, the nuisance arising from burning bricks in open clamps, with sifted dustbin refuse, was the cause of very great complaint and annoyance in Hampstead. A distinction must be made between burning bricks in properly constructed kilns, in which coal-dust was used as fuel. Here, little nuisance was caused beyond the smoke given off; but when dustbin refuse was used in open clamps, no amount of sifting out of soft core would prevent the putrid emanations. So great had the nuisance become in the Fleet Road brickfields, that the Hampstead Vestry had applied for an interim injunction to restrain owners from carrying on the business, but, owing to the application having been made on the last day but one before the legal vacation, Vice-Chancellor Bacon had declined to hear the case, on the plea that the nuisance had been going on for three years. The Hampstead Vestry has now commenced an action at Common Law against the owners of the brickfield, which, it is expected, will be shortly tried.

Dr. ILIFF drew attention to the arrangements at work in the parish of Newington for the disposal of dust, house refuse, manure, roadslop, etc., and gave the following account of the chief points connected therewith. In the centre, almost, of the parish, is a plot of land of 71,265 feet in extent, through which the London, Chatham, and Dover Railway runs; this ground was secured in the year 1871, at the cost of £4,163 5*s*. (two houses being included), and 17 double railway arches were then rented for 999 years, at £340 a year rent. A siding was then made to receive 27 trucks, a steam crane erected, now almost superseded by a lift with room for four trucks, so that they can be filled direct by tipping the carts, raised by the hydraulic lift, passed on to the weigh-bridge, and so on to the siding. He might say that the railway, by sending a special engine to take out the loaded trucks at noon each day, and leaving a fresh supply of empties, would enable the Vestry to load as many as 50 trucks a day instead of 27, should occasion require it. The arches were used for stables, store-rooms, cart-sheds, and also for the mortuary, post-mortem examination room, and disinfecting chamber. Under the old contract system, which yearly increased in price, the cleansing of the district depended very much

on the demand for ashes and breeze. Under the present system, the Dust Inspector is always allowed sufficient horses and carts to keep the district free of any accumulation, whereby the dustbins of the courts, alleys, and poorer class of property especially, are regularly emptied. So, also, as regards the roads; no accumulation of slop or drift is allowed, space being at all times reserved in the depot for the deposit of road sweepings. The Vestry and its officers have always felt that simple destruction of vegetable refuse was not a proceeding worthy of adoption; in the judicious admixture of the soft core, stable dung, and road scrapings, conducted so as to be free from sanitary evil, they believed would be found a most valuable agricultural manure, far too precious to be simply destroyed, and this has formed the leading feature of the work carried on. At first, house refuse and road sweepings were simply mixed together and sent down into the country; but the farmers very naturally objected to old pots, tins, broken glass, etc., which were not only a nuisance, but injurious to the feet of their cattle. It became necessary, therefore, first to fork out the hard core, and then separate the ashes, breeze, and vegetable refuse. This latter is mixed with road scrapings, improved by the addition of the stable dung of 1,000 horses, and is allowed to rest for several weeks, when it is sent down into the country. Fish and meat offal were collected by their own vans, and shot at once into the trucks, well covered over with disinfectants, ashes, etc., and no possible nuisance caused thereby. Of late, however, the Vestry have entirely ceased to collect, owing to the Railway Company not being prepared to carry the offal through the summer months. In everything connected with the depot disinfectants are used without stint, and the greatest cleanliness in the yard carried out. The enormous increase of traffic from the Vestry's sidings, and the amounts paid to the Railway Company, were as follows.

	Tons.	Amount paid.
		£ s. d.
From July 2, 1873, to March 31, 1874	13,764	1206 15 9
„ April 1, 1874 „ 1875	20,876	1694 9 0
„ „ 1875 „ 1876	22,161	1976 1 1
„ „ 1876 „ 1877	25,493	2630 5 4
„ „ 1877 „ 1878	41,629	4342 14 1
„ „ 1878 „ 1879	42,490	4278 8 3
„ „ 1879 „ 1880	45,259	4485 15 9

The Vestry pay about 1*s.* 8*d.* a ton for any distance within a radius

of 25 miles, with an extra 1*d.* per ton per mile to stations beyond that distance—in the year ending Lady Day, 1884, this latter was paid on 4,813 tons below Faversham. The amount realised in the same period over and above cost of carriage was £2,439 14*s.* It was soon found that two or more depots were necessary in the country, and for various reasons,—first, to keep the town yard free of accumulation; and secondly, to form a storage for mixture, ashes, and breeze, to secure a fit and proper market. Sometimes the brick trade is very dull, and sometimes the farmers cannot spare their horses to fetch the manure. Again, the vegetable matter in the sorted dust becomes destroyed by storage, and the ashes are rendered more valuable than when sold direct from the sieves. These and other considerations led to the leasing of two acres close by the Meopham Station, and by the purchase of two acres of freehold land at Longfield. At the latter place extensive works have been carried out; a siding, main walls, cross-walls, a furnace for the burning of old mats, etc., etc., have been erected; and in the construction a large quantity of broken hard core and breeze has been mixed with the Portland cement, thus saving the use of Thames ballast. Five docks have been formed at Meopham depot for the deposit of mixture—

No. 1 dock,	with a railway	frontage of	88 feet,	to hold	400 tons.
„ 2	„	„	70	„	800 „
„ 3	„	„	92	„	1000 „
„ 4	„	„	91	„	1000 „
„ 5	„	„	123	„	1000 „

At Longfield, seven docks have been formed, to provide a shoot for 8,000 tons of mixture, so that the Vestry are provided with space in the country, at the two depots, for the deposit during the summer months of 13,000 tons of mixture, which is in excess of the quantity made during any six months of the year. Hence the farmers in the district purchase these deposits at the current price, viz., 3*s.* 6*d.* per ton. The whole arrangements are a great success, carried through under the greatest difficulties, unique in character, and affording the most valuable practical guide to other parishes. Valuable as has been the co-operation of the Depot Committee in the matter, the credit is yet in the highest degree due to Mr. Dunham, the Vestry clerk, who for nearly fourteen years has devoted himself to the work, in season and out of season: he being fully satisfied of the value of it, not only on sanitary, but also on commercial grounds. One fact alone will prove the latter, viz., that in the nine years ending Lady Day, 1882, 291,943 tons of refuse have been sold, realising £46,282, with

a loss in bad debts of only £208. Dr. Iliff had carefully watched the progress throughout on sanitary grounds, and had seen with satisfaction improvement succeed improvement; and he could confidently assert that no illness, either to the employés or to the surrounding neighbourhood, has arisen to forbid its continuance. In a word, by the operations at the depots (town or country), the road slop is got rid of, the house refuse regularly removed and utilised, accumulations of manure in close yards prevented, and the general health of the parish thereby improved; whilst a most valuable material finds its proper place on land, which it fertilises, and comes back to us, after helping to pay for its removal, in the shape of food and fodder, fitted for the consumption of man and beast.

Dr. KELLY spoke of the intolerable nuisance produced in some villages by the conveyance of offal from the Metropolis. Much depended on the way in which the material was treated at the time of conveyance and deposit. Fish offal was especially offensive, but stable manure was not.

Professor CORFIELD said, that although, like the President, he had been for a number of years engaged in a parish where there were few offensive businesses, he had formerly had the advantage of succeeding Dr. Ballard, as Medical Officer of Health for Islington, and he wished to point out that most of the improvements that had been made with the view of abating the nuisances from noxious businesses had been adopted successfully by Dr. Ballard in Islington before 1874. He was able to bear evidence as to the improvement that had been produced in most of those businesses, with all, or nearly all, of which he had, at that time, a great deal to do. He had listened with the greatest interest to Mr. Spencer's important and valuable paper, and could corroborate what he had said in most particulars. He quite agreed with Mr. Spencer that the making of artificial manure from coprolites produced a most offensive nuisance, and this was especially the case when putrid animal matters were ground up with the coprolites and sulphuric acid. He also drew attention to the excessively foul nuisance produced by a business of which Mr. Spencer had merely mentioned the name,—that of gut-scraper. This was, according to his experience, one of the most difficult to deal with, as it was necessary for the process that the guts should be kept until they were putrid, in order that the mucous membrane might the more readily be scraped off. The stench produced by the places where this business was carried on was intolerably disgusting. He had lately had his attention drawn to the excessive nuisance produced by brickmaking,

especially when the contents of dust-bins were used for the fuel, and also the sifted portion mixed with the clay used in making the bricks themselves ; and he could quite corroborate what had been said by previous speakers, that the stench was intolerable, and travelled for very considerable distances. In their opinion, the men who work at most of these offensive businesses do not suffer from them, but, on the contrary, enjoy good health ; those who conduct such businesses have no less an authority than Parent Duchatlet on their side. After making inquiries into the health of the workmen employed in a number of these offensive businesses, he came to the conclusion that in scarcely any instance did they suffer in health in any way from their occupation ; but that did not prevent such businesses being a nuisance, and also injurious to the health of persons not continually employed in them. He quite agreed that the best plan was to devise means by which these businesses should not be a nuisance to the neighbourhood in which they are conducted ; and to show how much had been done in this way in recent years, he mentioned that he had heard the great French professor of hygiene, Bouchardat, say, in 1869, that the best way to deal with these offensive businesses would be to group them all together, the result of which would be that the fumes given out by the chemical works would, to a certain extent, counteract the effects of the foul organic vapours given out from some of the other businesses, and so a city of stinks would be formed in which the stinks would neutralise one another.

Mr. SPENCER, in summing up the discussion, stated, in answer to Dr. Dudfield, that it is quite practicable to destroy offensive effluvia arising from organic matter by passing such effluvia through a good furnace-fire. He found it difficult to ensure such fires being always maintained, excepting where a mechanical stoker was used. Such a stoker was in use at the works referred to by Dr. Dudfield; and any occasional nuisance caused by these works did not arise from unconsumed organic vapours passing out of the chimney shaft. Mr. Spencer, however, recommended that offensive vapours should, where practicable, be passed through a coke or other washer before reaching the furnace. With regard to the nuisance caused by the collection of offensive material on the premises of marine store dealers, Mr. Spencer said that the Metropolitan Board of Work were of opinion that the remedy could be found under the Nuisances Removal Acts, and that appeared also to be the opinion of the Medical Officers of Health in the metropolis generally. With reference to the case of nuisance from the burning of bones for the manufacture of animal

charcoal, cited by Dr. Rogers, Mr. Spencer stated that improvements were being made in the processes carried on at the works in question, which would, he thought, get rid of the nuisance. As to the nuisance from fish-frying, mentioned by Dr. Saunders, Mr. Spencer said he concurred in the opinion that the adoption of a hood connected with a chimney-shaft did not dispose of the effluvia. He believed a remedy would be found in carrying on the process in an inner room instead of in the open shop, as is usually the case. The room should have only one opening, protected by a canvas curtain reaching nearly to the floor. The fire and ash-pit should be enclosed, and a large air-shaft should lead from the upper part of the room into the ashpit. This plan, he said, had been tried with success in small tallow-melting works; the fire draws the hot, offensive vapours out of the room through the shaft and burns them; the fresh air enters the room under the curtain, and no offensive smell escapes into the external atmosphere. Replying to Dr. Corfield, Mr. Spencer said that great improvement had been made in Belle Isle since Dr. Ballard's time, especially in getting rid of the nuisance caused in the manufacture of catgut. Mr. Spencer said it was quite practicable to burn bricks without public nuisance. Probably the chief source of offence from the existing system was from the burning of the soft core, which consists of vegetable and other offensive matters collected from London dustbins. This is usually separated at the brickfields from the cinders, etc., and is burnt in the open air without any precautions, causing a horrible nuisance throughout the district. In addition to the successful method of disposing of such refuse adopted by the Vestry of Newington, many towns had got over the difficulty by using Fryer's "Destructor", or some other similar appliance, in which the material is burned without offence.

ON THE STATUS OF THE MEDICAL OFFICER OF HEALTH AS A CRITERION OF SANITARY PROGRESS.

By HENRY E. ARMSTRONG,
Medical Officer of Health for Newcastle-upon-Tyne and the River Tyne Port.

(*Read: December 19th*, 1884.)

The year now drawing to a close will ever be remembered in the history of hygiene. The completion, with a success that must have transcended the most sanguine hopes of its far-seeing promoters, of an undertaking so various and so comprehensive as that of the International Health Exhibition, is an event which marks in a striking manner the interest taken by the English in at least the popular side of a special department of practical science, and may be regarded as the outcome of the training they have been undergoing during the past decade and more.

It would be well if the success of the Exhibition were a gauge of the popular mind as to the real importance of hygiene and all that is included in the term. But in health matters, under the influence of enthusiasm at one time, of panic at another, your Englishman, like men of other nationalities, acts in a way wholly unlike his real self of every-day life.

To have a correct appreciation of the public desire for sanitary progress, we must examine the evidences apart from emotion or sentiment, and for this purpose I propose to judge it by the position accorded to the chief persons authorised to inculcate sanitary principles and promote sanitary practice throughout the country, viz., Medical Officers of Health. In the course of this paper, I believe I shall show that this position is such as to justify the conclusion that much of the sanitary advancement on which the people are apt to pride themselves is more apparent than real, more particular than universal; and that, as was said of moral virtue by an eminent writer, there is an aristocracy of hygiene "exhibiting the most refined excellence in their teaching and in their actions, but exercising scarcely any appreciable influence upon the masses of the community". If

this state of affairs be true, the sooner it is recognised and remedied the better for all concerned.

The subject has a twofold importance ; first, to the nation, in whose service we are engaged ; and second, to ourselves. The proposed method of treating it, *i.e.*, to judge of the sincerity of the public by their behaviour and that of their representative bodies to their principal officers, is at least as fair as others, and is, perhaps, less liable to error than the oft-applied test of amount of money spent for other sanitary purposes.

I believe I express the feeling of our body generally in saying that in the present state of opinion, and the perpetual conflict between private interest and public duty, the post of an earnest, conscientious Medical Officer of Health is one of devotion, danger and self-sacrifice, scarcely justifiable, considering the inadequate return he receives for filling it. Not that he fails in appreciation of the high character of his calling, or his desire to maintain it at any price. His ever-increasing duties bring with them increasing anxiety and responsibility, and the need of additional effort, without compensating benefit to himself. A practical exponent of virtue, which, according to Pythagoras, means "to seek truth and do good", he too often finds his conduct its own and only reward.

Accordingly as the aim of an Officer of Health is the practice of philanthropy, the acquisition of fame, or the gaining of a reputable and moderate livelihood, he will be satisfied with a different recompense. The prospect of success in the pursuit of either of these objects by the Apostle of Sanitation is unencouraging. I doubt whether it was ever bright enough to attract one sincere votary of the first ; the second is open to but few ; the effort to gain the last is power misdirected, and certain to end in more or less of disappointment, since half the ability and application necessary for the requirements of his office would secure for him double or quadruple the emoluments, if directed to the ordinary practice of his profession.

During the period from the passing of the Public Health Act of 1872 to the present time, State Medicine may be said to have undergone a revolution, so different are sanitary matters now from what they were before the appointment of Officers of Health in every district of England and Wales. That the nation has benefited thereby is commonly admitted. The Local Government Board, in their Report for 1881-82, refer to the "steady improvement of the public health as indicated by the progressive reduction in the death-rate", that of 1881 having been "lower than that of any other year since the esta-

blishment of civil registration in 1837." The same report also speaks of the progressive diminution in the mortality from zymotic diseases "as a matter for special congratulation". The credit Medical Officers of Health deserve for their share in bringing about these satisfactory results is probably greater than will ever be allowed them. Be this as it may, the advantage to the nation from the development of State Medicine during the past ten or twelve years has not been accompanied by any appreciable benefit to the principal officers concerned in the administration of the laws relating to public health. On the contrary, in some respects things have changed for the worse. It is, perhaps, not too much to say that the general feeling amongst Health Officers is, more or less, one of dissatisfaction; and in not a few instances it has been the bitter experience of such officers to find a decade or more of hard uphill work in the public service, as regards their own position and interests, so much time and energy thrown away.

The cause of this dissatisfaction is not far to seek. The position is not what it was expected to be, or to become. The appointments are disappointments. Instead of being improved, the status of the holders is, at best, *in statû quo*.

The standing of Medical Officers of Health as a whole is affected unfavourably by circumstances of two kinds—external and internal. For the former we are to be pitied; for the latter, blamed.

The *external* causes of dissatisfaction may be considered under five principal heads, viz.:—

1. Different Health Appointments compared with each other.
2. The Medical Officer of Health compared with other public officers.
3. Relations of the Officer to the Sanitary Authority—as regards engagement; tenure of office; respect paid to advice; authority given; certain personal relations; recompense; prospects.
4. Relations to the public.
5. Relations to the Local Government Board.

Different Health Appointments compared.—Anything more anomalous than the different areas and appointments is difficult to imagine. System, rule, law, or principle in the determination of these there would seem to be none. Districts are big or little, combined or single; officers are allowed private practice or are debarred from it; the terms of appointment are without limit, for a few years,

or only for one; inconsistency is the prevailing feature. In an able paper read before the Society not long ago, Dr. Armistead showed that of 553 rural sanitary districts, about one-fourth only are combined; nearly half have a resident practitioner as Officer of Health; and the remainder, 137 in number, have 383 Poor-law Medical Officers as Health Officers, or an average of three to each district.

Urban health appointments, held by officers who give all their time to duty, though open to less objection on the score of inequality, are not, in the foregoing respect, what might be desired. Unless there is considerable difference in the interpretation of the duties in different places, it is difficult to understand how one man can fulfil the requirements of Health Officer to a city of 500,000 inhabitants, if the whole time of another is occupied in attending to a town of one-sixth the size. Either the one officer has too much to do, or the other too little; or the duties in the two districts are not alike. As for the Health Officers in still smaller urban districts, who for a small salary undertake to give the whole of their time, these are either always on the *qui vive* for a more lucrative appointment or they are men from whom little is to be expected.

Want of combination among rural and small urban districts, and what it leads to—viz., the appointment of Poor-law Medical Officers, or private practitioners, as Health Officers—are felt by those best qualified to judge to be serious impediments to sanitary progress. The former indicates fault on the part of the authority, either from apathy or more decided sentiments (such as those of a certain Local Board, which distinguished itself by its determination to "do nowt that cost owt, and owt that cost nowt"); the latter, with few exceptions, means that the duties are not done or intended to be done properly by the officer who undertakes them. Whatever excuse there may be for the accepter of such an office there is little or none for the makers of it.

An examination of the salaries of different appointments shows that many of these have been fixed in an arbitrary and irregular manner, and apparently without any basis of comparison with other districts. Thus, in the cities and towns of England, with populations of 100,000 and upwards, the salaries, compared with rateable value of the towns to which they respectively refer, range gradually from a maximum of £1 in £800 to a minimum of £1 in £3,795. Compared with population, they range from £1 for every 246 persons in one town to £1 for every 924 in another.

In the Northern Counties the salaries in urban districts range from

a maximum rate of £1 per £100 of rateable value to a minimum of £1 per £2,400. The population to be attended to ranges from a rate of 49 to one of 800 per £1 of salary. In the rural districts the acreage to be covered ranges from a rate of 57 to one of 6,600 acres per £1 of salary, and the population from one of 89 to one of 700 per £1 of salary. Details of the foregoing statistics are given in the following Table.

1884.

NORTHERN COUNTIES OF ENGLAND.—*Range of Salaries of Medical Officers of Health calculated on Rateable Value, Population, and Acreage.*

County.	URBAN DISTRICTS.				RURAL DISTRICTS.			
	Rateable Value.		Population.		Acreage.		Population.	
	Amount per £ of Salary paid.		Persons per £ of Salary paid.		Acres per £ of Salary paid.		Persons per £ of Salary paid.	
	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.
Northumberland	100*	1863†	100	600	80	6600	94	430
Durham	580	2400‡	150	800‡	57	2512	89	700
Cumberland	100	2900	49	325	360	6000	90	230
Westmorland	? Four of the five Urban, and all of the Rural Districts, are in one combination.							

Inequalities such as the foregoing tend to bring the sanitary service into disrepute. The amounts paid in some of the large towns are not unfrequently quoted in other districts to the substantial disadvantage of the officers of the latter.

In comparison with the status of other principal public officers

* In private practice. Actual salary, £100 per annum.

† Not in private practice.

‡ Another of £1 in £6,000 rateable value and per 1,790 persons, with the addition of one guinea per day "when required". In Durham, three rural sanitary districts are each sub-divided between three Medical Officers of Health. The salary per acre varies largely in these districts. The salaries in the different divisions of the same district also vary considerably in relation to population, in one district being at the respective rates of £1 to every 89, 180, and 254 persons. The actual salary in each of these cases is the same (£50); the actual populations range from 4,460 in one to 12,706 in another.

that of the Health Officer is most unsatisfactory. It must be allowed that the offices of Town Clerk, Engineer, Treasurer, and Magistrates' Clerk are all senior to our own, and are on that account entitled to priority. But without disputing their title to the salaries they receive, which are doubtless well-earned, in what respect are the services of any of these gentlemen more valuable than those of the Medical Officer of Health that they should be paid on so much higher a scale?

In the sixteen extra Metropolitan cities and boroughs of England having populations of 100,000 and upwards, the average yearly salary of Medical Officers of Health who give the whole of their time to public duty is £553, ranging from £400 to £900.* The salaries enjoyed by other officers of large English towns is as follows:—

Office.	Average Salary.	Range.	No. of Towns to which the Return applies.
	£	£	
Town Clerk	1156	800 to 3000	15
Clerk to Magistrates	850	650 to 2100	16
Treasurer	710	250 to 1300	10
Borough Engineer, Surveyor, etc.	640	300 to 1000	16
Gas Engineer	900	500 to 1300	5
Water Engineer	800	500 to 1200	5

In the above list no account is taken of the salaries of deputies and assistants, of whom several town clerks, magistrates' clerks, and engineers have one or the other.

Have any of the above-named officers to undergo more preparatory training, obtain higher legal qualifications, accept greater responsibility, or run more risk of offending their employers, than Officers of Health? Have they or their families to incur equal danger with him or his?

In the foregoing examples, to us at least, "caparisons are odorous" indeed.

Before leaving the subject of fellow-officers, I regret to have to observe that the Medical Officer of Health does not always meet with the cordiality and support from the Clerk to his Authority that might be looked for between one professional official and

* In seven of the towns, other minor public appointments are held by the Medical Officers of Health, for which additional payment (in some cases very small) is received.

another. Instead, jealousy is occasionally evident; and the result is sometimes believed to be anything rather than profitable to the holder of the junior appointment (particularly in regard to salary).

In certain of his relations to his Sanitary Authority, the Health Officer has often cause to complain that he does not receive proper consideration. I do not wish to speak disrespectfully of Local Authorities in general. No one appreciates more thoroughly than myself the difficulty of their position, and the large amount of time they spend and trouble they take for the public, often with little thanks. But Local Authorities, in their zeal for those they represent, are sometimes inconsiderate toward those they employ, among whom the most liable to injustice is, perhaps, the Medical Officer of Health. He is in most instances appointed for a short period, in an experimental sort of way, unlike other officers. He is not encouraged by the knowledge that after a year or two he may undergo the annoyance of having the question of his re-appointment, or otherwise, discussed, and his election contested (possibly to his defeat) by a rival in local general practice. If the area for which he acts is a combined sanitary district the chances are that the combination is weakened by the withdrawal of parts, or perhaps broken up altogether in favour of the engagement of local practitioners to undertake to do the work for less pay. The Society needs no illustrations on this score.

Although legally and ostensibly the Medical Adviser of his Authority, the advice of the Health Officer is frequently unpalatable and is not desired by them. It may be treated with respect, as Dr. Tripe, in his Presidential Address four years ago, affirmed (if courteously tendered, an Authority would indeed be rude to treat it otherwise); but if that is all, the officer would better have remained silent.

There are certain matters on which the advice of Medical Officers of Health would be specially useful, but which in very many cases, if not in most, is either not sought, or, if offered, is ignored by their Authorities. I refer more particularly to the framing of Sanitary Bye-laws, Sanitary Sections of Local Parliamentary Bills, and reports on Plans for New Buildings. How far the influence of other officers is accountable for this is difficult to say.

In most of the small, and not a few of the larger, districts, Medical Officers of Health complain of the unwillingness or refusal of their Authorities to print the Annual Reports which it is the duty of the officers to make. Doubtless one reason of this is the mere cost of

printing; probably the desire to avoid outlay for defects reported is another.

Sanitary Authorities, especially in the smaller districts, do not, as a rule, give their Health Officer control over the Inspectors of Nuisance, although they have power to do so. The result is that the Inspectors, especially in rural districts, having no one to train or direct them, work in lines different from, and often at variance with, those of the Health Officer. I have known an Inspector systematically encouraged to oppose and contradict the Medical Officer, which he did zealously and jealously. When Inspectors communicate with their Boards directly and independently, it occasionally happens that an Authority receives conflicting reports on the same sanitary matter from different officers.

The personal relations of the Medical Officer of Health to the different members of his Board are, in very many instances, most agreeable, and productive only of mutual respect and goodwill. Especially is this so when the Authority is joint or representative, and the members occupy good social positions. Here dignity rules, and courtesy has her seat. The angry voice of the tenement property owner is not heard at the Board; this is no place for him whom the pulpit has proclaimed "a predestined villain whose damnation is just,"—the jerry-builder. Here, truly, is the paradise of Medical Officers of Health, and few there be that find it!

Recompense.—Health Officers are improperly recompensed. There are other modes of remuneration than the pecuniary one. For the present, I will, however, confine my remarks to this.

The income of the Medical Officer of Health who gives the whole of his time to duty is seldom more than half that derivable from a very ordinary private practice, and, as has been shewn, compares perhaps still more unfavourably with that of other professional public officers. The amount he receives is not unfrequently doubly worked for; *i.e.*, extra service not included in his proper duty is required of him without extra payment. Such extra services may include hospital administration or superintendence, sanitary work beyond the district, attendance at sessions, etc., or clerical work. In one case within my knowledge an attempt was made to get the public analysis of a large urban district done by the Health Officer without giving any additional salary; but, as the Local Government Board refused their consent to this, the difficulty, so far as the Sanitary Authority was concerned, was overcome by paying their officer a mere trifle as Analyst.

Health Officers are sometimes glad to do other, even unprofessional, work for their Authorities without extra payment, in order to secure themselves from reduction of salary for legitimate service. One well known case of this kind was specially discussed by the Society a few years ago.

The Local Government Board have frequently in their Reports referred to the insufficiency of the salaries offered.

Salaries have, in numerous instances, been reduced on the re-appointment of an officer. A case in point is reported in the *British Medical Journal* of the 6th of December of this year, "which the Local Government Board hesitated to confirm, and urged the Authority to reconsider it, which they did, but adhered to their decision." The Medical Officer of Health was afterwards asked if he would consent to the reduction, and replied that he "had no alternative but to do so." Thus a Sanitary Authority may "clip the wings" of a too zealous servant!

One of the effects or concomitants of want of combination of small districts is the unsatisfactory distribution of the amount of money paid in salaries. In the four Northern Counties of England the total yearly amount so paid to Medical Officers of Health is £7,595, distributed as follows:—

		£	s.	d.
Northumberland	Urban Sanitary	1,050	13	0
,, ...	Rural ,, ...	990	0	0
Cumberland	Urban ,, ...	720	0	0
,, ...	Rural ,, ...	815	0	0
Durham	Urban ,, ...	2,035	19	0
,, ...	Rural ,, ...	1,387	0	0
Westmorland.....	Urban ,, ...	597	0	0
,, ...	Rural ,, ...	—		
		£7,595	12	0

Much of this money is spent inappropriately, *i.e.*, it is paid to officers who do not give a sufficient return for it. It would probably be found that the salaries of Superintendent Medical Officers of Health over entire counties or large areas, with that of District Officers under their direction, would amount to little, if anything, beyond the amount paid at present, whilst both the community and the sanitary service would profit by the change.

The *prospects* of the Health Officer are not bright. His almost sole hope of improvement is that he may get a better appointment;

and this he soon finds to be a lottery of many blanks, and few, though eagerly contested, prizes.

What is to become of his family in the event of his being taken off by fever, to which he is continually, in the discharge of duty, exposed?

What provision for his declining years has he to look forward to, from those whom he has faithfully served?

His relations to the public are exceptionally trying. Ideally, he "comes as a boon and a blessing to men"; in reality, the men he comes particularly to would rather he stayed away. Duty to the community brings him into perpetual conflict with the interests and liberties of private individuals. Fault-finding is his business, and blame (from some, at least) his reward. One charges him with doing too little; another with doing too much. In such matters as the prevention of infectious disease he is called to do a great work, but is entrusted with little means to do it with. It is his task to make bricks without straw.

In the performance of duty, and indeed in all his official relations, the Medical Officer of Health should know that he may look with certainty to head-quarters for criticism, counsel, and support.

To satisfy his Sanitary Authority should never be his only, and perhaps in some cases without impropriety may not be his chief, aim. It is, I think, much to be regretted that there is not a closer connection between the Local Government Board and the Chief Officers of the different Authorities whose actions it is the function of the Board to watch and to some extent to control. It is true the kindly advice of the Medical Officer and Assistant Medical Officer of the Board, on matters within their province, is always freely given when asked for. But if, as I believe, it is no part of their proper duty to advise in this way, we are not justified in encroaching upon their time to consult them. Beyond help thus given, there is seldom any official interference on the part of the Board with the Health Officer—either in the way of instruction, praise, or blame. In troubles with his Authority he must fight his own battles.

The long-looked-for County Bill, when it appears, will, it is to be hoped, contain provision for the appointment of at least Superintendent Medical Officers of Health, in immediate relation with, if not solely under, the Board.

I now approach the most delicate part of the task I have undertaken, *viz.*, the *internal* causes of dissatisfaction with the position of

the Health Officer. I trust the observations I have to make may be received as they are offered—with goodwill.

How much soever our status is affected by outside circumstances which we cannot control, we are ourselves responsible to a great degree for the position we occupy. The body suffers for the faults of its members. The invariable rush after petty appointments lowers us in the eyes of those whose service we would enter, and ends in enabling them to get their man at a cheaper rate. The value of an article is what it can be bought for. Working-men know this, and act on the knowledge.

Failure to appreciate and accept the responsibility involved in a health appointment, as proved by the scanty Annual Reports of some Officers, to which the Local Government Board pointedly refer, brings discredit on others as well as the writers.

Intimacy between the individual Members of an Authority and their professional Officer may be, and sometimes is, carried too far. The latter should be uniformly courteous to all, but on no account familiar with any. This applies equally to fellow officers of every grade.

More difficult to treat of, and more distasteful to the writer than any other matter in connection with the subject of this paper, is that of the Medical Officer of Health who is a private practitioner. I trust the few remarks of one who sincerely believes that the two kinds of work are incompatible, may be acquitted of all intention of personality towards the main body of Health Officers in London, who, as the pioneers of the Sanitary Army in England, are entitled to the utmost respect. In this matter the pure Medical Officer of Health—as he may without superiority be termed—having only one string to his bow, claims a consideration to which the "mixed" Officer is not entitled.

At this time of day the idea should be abandoned that preventive and curative medicine can be worked out successfully by the same person. Candid general practitioners will admit that "cure" takes all their time. To attempt both that and prevention is like trying to follow two trades, or to sit on two stools. Things were different when the metropolis was first divided for health purposes. Sanitary science was then a babe. She is now grown up, and will not be content with half a man.

It is the example of London—so laudable in the past—that has led

to the petty, half-time appointments in the provinces—so deplorable at present.

Medical men in general always dislike and oppose a Medical Officer of Health who is their rival in private practice. Dr. Tripe, with all his experience, tact, and urbanity, says,* the position of Health Officers, like himself, in relation to general practitioners, is "a difficult one. They look with suspicion upon us. . . . . Very few co-operate cordially with us." What must be the feeling in small towns and country places, where the number of practitioners is small and the rivalry all the more keen?

It is related that when Pericles took the duty of chief scavenger of Athens, he remarked that if the office conferred no dignity on him, he, at least, would confer dignity on it. The Medical Officer of Health of the present time, in assuming his duty, may perhaps have the small satisfaction of flattering himself that, in his way, he is, to some extent, playing the part of a Pericles. Owing to the want of popular interest, the honour of his position depends on himself alone.

The foregoing statement shews that the functions, duties, and position of the Medical Officer of Health are not fairly appreciated by the public or their representatives, and that his status is impaired by the action of individual members of his own body.

Of the *external* causes of dissatisfaction above-named, each points to the conclusion that the public are not yet sufficiently in earnest in regard of State Medicine, otherwise they would make the position of the officers they engaged to advance it one of more importance.

With grounds of complaint such as described, against those in whose interest he is supposed to work, the Medical Officer of Health cannot devote himself to his responsible duties with either the energy or the zeal his office requires. No matter whether he be allowed a private practice or not, the present arrangement is faulty. On the one hand, the remuneration and terms of his engagement generally are such as to fix the idea from the first that, in most cases, the office is, and is intended to be, a sinecure; on the other, the officer feels that whether much or little is expected from him, his income from professional sources is unduly restricted. In neither of these cases has the officer proper weight and authority. In both, the seat of the officer is insecure, and may be made more so by any display of zeal on his part.

The foregoing circumstances inevitably re-act on each other, with

* Presidential Address, 1880.

the result that, both on the part of the public and the practitioner, the cause of sanitation, and, *pari passu*, the status of the officer practising it, suffer.

Were it necessary, the *claims* of the Medical Officer of Health to higher consideration might be urged, on account of his professional qualifications and the cost of preparing for these, the responsibility of his office, and on other grounds.

How the Status of the Health Officer may be Improved.

The status of Health Officers in general can only be raised to a proper level by the institution of many and great reforms, from without and from within. Most of the former have already been foreshadowed, and may be summarised as follows :—

1. *Health Appointments should be more equalised.*—This is to be effected by compulsory combination of small districts. There would appear to be a public advantage in a graduation, to some extent, of the resulting combined areas. This system would also be adapted to the advancement of officers as they gained experience. Each combination should be determined on considerations of areas or population. With certain exceptions, presently to be stated, no appointment should be less than sufficient to occupy the entire time of the holder, who should be debarred from private general practice. Small districts, urban or rural, should not be allowed to engage all to themselves inexperienced officers at low salaries.

There should be a Superintendent Health Officer over each county or group of counties. This is necessary to secure unity of action, uniformity of report, and efficiency generally. Such an officer might, *inter alia*, adjust combinations, advise Joint Sanitary Boards on large questions, and act intermediately between authorities and the Local Government Board.

2. *The Local Government Board should exercise greater control over Appointments.* — For this purpose, Superintendent Medical Officers of Health should be solely appointed by, and directly under, the Board. Combinations of districts should be made on the order of the Board, and should not be broken up unless by their consent. The District Medical Officer of Health should be appointed subject to confirmation of the Board, and should not be removable without their consent. In the discharge of his duty this officer should be able to rely confidently on the criticism, counsel, and support of the

Board, either through the medium of the Superintendent Officer or otherwise, as circumstance required.

The duties of the district officers should also be specified by the superintendent.

Now that the country has had ample experience of the working of the Public Health Acts, it is desirable that the general duties of Health Officers should be defined by the Board more explicitly than is the case at present; they should also be extended in some respects.

3. *Local Sanitary Authorities should not be able to ignore with impunity the sound advice of their Health Officer.*—The District Medical Officer should make his reports on a specified model framed by the Superintendent Officer, so as to suit the requirements of each district, and to omit no subject which ought to be dealt with. These reports should be printed, and copies should be supplied to the Local Government Board, the Superintendent Medical Officer, and, at a reasonable charge, to every ratepayer who may wish to purchase them. As a sequence to the reports, the Authority should be required to publish and forward to the Board, from time to time, a statement of their action thereon, or the reasons for no action having been taken.

No sanitary work should be instituted or carried on in the district without the District Officer of Health reporting in writing as to its advisability or otherwise.

4. *The Authority of the Medical Officer of Health should be extended.*—The nature of the duties a Health Officer has to perform require that he should have independence of action. He should not, for instance, be "under the thumb" of tenement property-owners, whether these are members of his Sanitary Authority or not. It does not follow that he would be any the worse as an officer on this account, but the reverse.

In all cases the Inspectors of Nuisances should be under the control of the Medical Officer. Their appointment and removal should be made on his recommendation. Their reports should be made to him. The ill-effects of the want of this arrangement have been much felt in districts where it obtains.

I do not concur in the opinion that the office of Inspector of Nuisances can be filled by a young medical man. The duty is too responsible. It also requires mature judgment and other qualifications only to be gained by age, and ought to be entrusted only to practical men of experience and fair education. The Medical Officer of Health may, with advantage, have the assistance of a young medical man; and he should be at liberty to receive premium pupils, for whom he would, of course, be responsible.

The Medical Officer should be provided with proper offices for himself and staff, which should include a clerk or clerks.

5. *The Recompense and Prospects of the Medical Officer of Health should be improved.*—So long as salary, the most accurate gauge of status, remains in its present unsatisfactory condition, the position of the Health Officer cannot be materially improved.

Alteration of sanitary areas would necessitate the redistribution of salaries, which, as has been shown, are very unequal. The remuneration in each particular district should be determined on some regular basis, say rateable value, and should always be (as it now is sometimes only) fixed by the Local Government Board. Part of the salary should be paid by Parliamentary grant.

Devotion to the sanitary service should not entail a sacrifice on the part of the officer. He is entitled to a remuneration at least as good as he would have acquired in average private practice, or the average paid to other professional public officers,—an amount which may, for juniors, be put at from £500 to £800 a year; and for seniors, at from £800 to £1,500 and upwards.

In case of satisfaction being given by the officer, he should have a regular increase of salary, according to a fixed scale, after, say, the first five years of office. Reduction of salary, by withdrawal of Local Boards from combination, or on the reappointment of a competent officer, should not, an any account, be allowed.

Certain additional sources of income should be available to the Medical Officer of Health. Thus, occasional extra work (*e.g.*, attendances beyond his district, or at the Law Courts, etc.) should be paid for according to scale, and not below market value.

When other appointments under the local Authority are held by the Health Officer, the remuneration for these should be adequate to the duties to be performed, and should not be determined by the fact that the Authority have previous control over the applicant for them.

In the opinion of some, the Vaccination Grant (£15,000 to £16,000 a year), together with the duty for which it is awarded, would be properly transferred to Health Officers, as specially relating to preventive medicine.

After long service Health Officers should receive pensions, as in most other departments of the public service.

6. *The Health Officer should have satisfactory tenure of his Office.*—The term of appointment should not be for less than five years; and, on reappointment, a satisfactory officer should be engaged for life—subject of course to the usual provision for misconduct, etc.

Seeing the nature of the duties and the opposition the officer is likely to meet if he acts without fear or favour, it is important that he should be as far as possible independent of those against whose interests he may have to work. He should, at least, be removable only with the full consent of the Local Government Board.

The reforms *from within* the body of Health Officers, to which attention is desired, relate partly to present and partly to future members of the Sanitary Service. We of the present should be guided in our conduct by the knowledge that we are working for posterity, and that our actions will form a precedent for our successors. On this account, therefore, it behoves us, as far as we can, to aim at the improvement of our office by concentration of energy on it and devotion to it, rather than by seeking our reward in other vocations not in harmony with it. We have to consider what other duties a Health Officer may, with advantage to his proper office, undertake in addition to his own.

Private practice, whether general or consulting, should not be sought after. This implies that the appointments should be sufficiently remunerative to render such modes of increasing the income unattractive. Private practice and, similarly, general hospital practice, is incompatible with that of preventive medicine, and distracts the attention of the Health Officer from his duty.

He may properly hold professional offices relating to the subject of hygiene—such, *e.g.*, as those of Medical Superintendent of a Hospital for Infectious Diseases, Coroner, Public Vaccinator, Superintendent Registrar of Births, Deaths, and Marriages, Lecturer on Hygiene at a Medical School, Examiner for University Degrees on Sanitary Science, etc. Under certain circumstances, also, he may hold cognate appointments, such as that of Public Analyst. He is seldom, however, sufficiently skilled in chemistry to do the last-named well; besides, unless he has assistance, the time required continuously for certain analyses will interfere with sanitary work.

A Health Officer should not accept any appointment beneath the dignity of a medical man to hold—such as that of Superintendent of Cleansing, Inspector of Nuisances, or Veterinary Inspector,—of which, unfortunately, we are not without examples.

The Medical Officer of Health of the future should not have to learn his profession after entering office as we have had to do. He should be prepared beforehand, as for the ordinary practice of his profession, by undergoing a term of pupilage and assistancy with a

Health Officer; and before applying for full appointment he should be able to show proof of his special attainments, in the form of a distinctive sanitary diploma or degree, such as that of Doctor or Bachelor of Hygiene by examination, after completion of a recognised curriculum.

It is, I submit, incumbent on this Society, as the principal deliberative body of Medical Officers of Health, definitely to express itself on the foregoing points.

I would suggest that the subject be referred to the Council for consideration and report to a future meeting, in order that the views of the members generally on the various questions raised may be elicited and recorded; and that, if possible, this may be followed by the obvious practical action required to bring about the much needed reforms.

In treating of the different subjects in this paper, I have purposely avoided reference to that of a Minister of Health.

I have to thank several friends for the frank expression, at my request, of their views, on points in which my own experience was deficient.

Discussion.

Dr. Dudfield, the President, after thanking Mr. Armstrong, in the name of the Society, for his able and interesting paper, observed that it related more to provincial than metropolitan experience. There appeared to be no legal relationship between the Medical Officer and the Sanitary Inspector, but the practice in London was that the Medical Officer was looked upon as the chief of the Sanitary Staff, and he was looked up to by the others as if he had a legal headship over them. The great point in the appointment of a Medical Officer of Health should be irremovability—he should be as firmly fixed in his office as a Poor-law Medical Officer, and the appointment should not be broken without the consent of the Local Government Board. Many officers were most inadequately paid, and very ill-requited for the work they did.

Mr. Jacob agreed with a good deal that Mr. Armstrong had said, and felt all that the President had remarked as to the tenure of office. The office in combined districts was most insecure. The district was sometimes broken up, and the Medical Officer felt, under

these circumstances that, although he might be re-elected over and over again, he was fettered in the freedom of advice he should give and the remarks he should make. He thought the Local Government Board were very largely responsible for committing the Authorities to appoint only for a time. In his own appointment it was proposed to elect him for five years, but the Local Government Board would not consent, and he was elected for only three years. He believed that Sanitary Authorities generally did give the recommendations of the Medical Officer their consideration, and treated him with courtesy and respect. And very often they do not do more because they cannot, owing to the times being bad and the farmers poor.

Dr. C. E. SAUNDERS felt that they were all much interested in the question of tenure of office. It often happened that a Medical Officer was re-elected by a new Board, who did not know him. He thought the Local Government Board did not give the support they ought to do to the Medical Officers, who should have a recognised position at the Local Government Board. He felt somewhat disappointed that the paper did not deal with the question of pension, as it was only proper that some provision should be made for old age.

The PRESIDENT remarked that there was full power in the metropolis to pension or superannuate the Medical Officer, but at the same time it was entirely voluntary on the part of the Authority.

Dr. WALFORD said he had heard of a case in the neighbourhood of East Kent recently, where the Medical Officer had been appointed permanently for all his districts, but it was the only case he had ever heard of.

The PRESIDENT remarked that the term of office in London was practically for life.

Dr. GIBBON, on the question of the relationship of Medical Officer and Inspector, said, the bye-laws or regulations generally stated that the Inspectors should take their instructions from the Medical Officer, but that was not so everywhere. It was a question that should be settled.

Mr. FURNIVALL (Acton) said the reports of Inspectors on sanitary matters were never before him until they had been before the Board. The district was outside the Metropolitan area.

The PRESIDENT stated that certain regulations of the Local Government Board, as to the appointment of officers, had been altered in 1878.

Dr. SEATON said he thought the status of the Medical Officer,

especially for urban districts, was unsatisfactory, and the question resolved itself into one of the Medical Officer of Health engaging in practice or being excluded therefrom. He was in favour of non-exclusion from practice, on the ground that public opinion was not sufficiently far advanced to give proper payment. He believed that sole devotion to public health was the most perfect state of things, but the state of public opinion was not such as to allow a satisfactory payment to be made for it. The very best of these payments, with exclusion from practice, was not sufficient. Take Glasgow, where it was £850 per annum. That might be enough for a person to live upon, but it was not at all commensurate with the character of the duties the Officers were called upon to perform. In Liverpool, the Port Authority appointed the same men as the borough. In Manchester the salary was £650, with exclusion from practice. One could not go too much in advance of public opinion, and they must wait. It would be far better for the Authorities not to exclude Medical Officers of Health from practice unless they are prepared to give proper remuneration to their Medical Officer upon the same footing as other officers, *e.g.*, solicitors, engineers, etc. He was also adverse to the present periodical system of re-election.

Mr. WYNTER BLYTH remarked that he had had experience in rural and also in Metropolitan districts, but he could do little more than substantiate the statements which had been already made. In Devonshire, the breaking up of his district was an instance of the insecurity of tenure; the reason for breaking up being because the adjoining Unions were paying £10 or £15 a year, whereas the Combined Districts were paying £200. There should be a closer relationship with the Local Government Board, who ought to be considered as a head; but, then, the Local Government Board, under a scientific aspect, was a disappointment—there was no scientific department. If you contrasted the German Boards of Health with the English Boards, the contrast was all in favour of Germany. In this country, Medical Officers of Health have not the Imperial support they should have. With regard to the relation of Medical Officer and Inspector, there should be strict discipline. One bad thing was that there was no qualification required for an Inspector —he need not pass any examination.

Dr. BATE said that in his parish the Inspectors were not under the Medical Officer. They reported to the Sanitary Committee, and he was not supposed to supervise them, and they were not responsible to him. He thought the offices of Medical Officer and Analyst

should be distinct, and that those officers should be allowed to have private practice.

Mr. HARTT said that in his district of Greenwich, he was both Medical Officer of Health and Medical Officer under the Poor-law Acts. He found that he was thus able to deal with unsanitary cases in the poorer neighbourhoods, which would not, perhaps, have come to light if that had not been so. In looking for one thing he often came upon the other; but the Local Government Board, he believed, were rather opposed to the principle. There was a case at Cork, where the Local Government Board disapproved of it, and would not consent until the Guardians had two or three times elected the person.

Mr. ARMSTRONG, in reply, said, that when he first took office he had no control over the Inspectors, but this was given him afterwards on a change being made in the staff, and the present arrangement worked well. He believed that he stood satisfactorily with his Authority, who had on several occasions shown their confidence in him. He quite agreed that the Government should have some voice in fixing salaries. As to the terms of his own appointment, he was, he believed, a permanent officer so long as he behaved himself properly. As to pension, he agreed that there should be some such provision as one of the terms of appointment. He felt they would be better for free communication with the Local Government Board. With reference to the observations of Mr. Furnival, he had no such personal experience. As to the case of a Medical Officer of Health and Parochial Medical Officer being the same person, and the arrangement succeeding because it led to better observation of sanitary defects,—a Medical Officer of Health should avoid making an Inspector of Nuisances of himself. The Notification of Infectious Diseases was in force at Newcastle, and he believed the medical men there were generally in favour of it.

ARE SMALL-POX HOSPITALS NECESSARILY *(PER SE)* A SOURCE OF DANGER TO THE SURROUNDING POPULATION?

I.

BY E. T. WILSON, M.B.Oxon., F.R.C.P.,
Physician to the Cheltenham General Hospital.

(*Read*: *January 16th*, 1885.)

I SHALL not occupy your valuable time by any apologies for my appearance here this evening.

I have come at the invitation of our President, who has thought, perhaps, that the remarks of one who is not a Health Officer, but a practising Physician, interested, indeed, in Public Health matters, but regarding them from a somewhat different standpoint, might possibly be acceptable. They are, at least, free from any suspicion of bias or party feeling.

The subject which I have chosen is one which seems especially appropriate at the present time, when the very existence of your means for isolating small-pox cases in London would appear to hinge on the answer which is to be given to the question I have asked.

It *may* be that it cannot now be answered, and if evidence clear and decisive is not yet available for its solution, it will be better to wait and collect facts before incurring the enormous risks and liabilities involved in a premature decision; for, as one of our former Presidents (Dr. George Buchanan, Royal Commission, Q. 3848) has truly said, if the experience of Fulham Hospital (as interpreted by Mr. Power) were shown to be a general experience, "Hospitals for acute small-pox cases would be impossible in London."

Without further preface, then, I proceed to examine the various channels by which the infection of small-pox is known, or suspected, to be propagated from a small-pox hospital as a centre, to the people in its immediate neighbourhood.

1. Defects in construction and situation of the hospital itself

may undoubtedly be a source of infection to those beyond its walls, —where, for instance, as at Homerton, "the windows of four wards are 25 feet from the footpath, and the laundry 10 feet 6 in., directing the steam downwards" (Tripe, Report, 1880); so close, in fact, that the spray from the tubs has actually splashed into the face of the Health Officer while walking in the street (Royal Com., Q. 2308); or where, as at Highgate, a four-foot wall and an open iron railing were all that divided a crowded court from the hospital grounds (Q. 3992, 4031); an entrance gate, so constructed as to necessitate the detention of an ambulance outside on its arrival; or administrative buildings so placed as to expose messengers and tradesmen to the chances of infection, are familiar instances of defects which can in no sense be considered irremediable; and there can be no insuperable difficulty—unless, indeed, we are to accept the theory of "distal aerial dissemination"—in so isolating the small-pox hospitals of the metropolis from their surroundings, that the passage of infection, otherwise than by the ordinary channels of "convection", shall be practically impossible.

2. Of the *Drainage* I shall say little; as, although suspicion was thrown upon the sewers by some of the witnesses before the Royal Commission, and more recently by Dr. Gwynn, no facts, as far as I am aware, have been advanced to prove that a case of small-pox has ever arisen from this source; although evidence, if it had existed, would, from the nature of the case, be decisive and overwhelming.

3. Passing on to the "necessary operations" of a small-pox hospital, the difficulties become greater, and the dangers less easily avoided; indeed, until the discipline of these institutions is assimilated more or less to that of H.M. prisons, there is little hope that the risks of infection can be abolished, or even materially curtailed. Rules for the regulation of the staff, resident and non-resident, can scarcely be too stringent or too absolutely insisted upon; and the fact that nurses and ward servants have been allowed to go out every evening for two hours, in addition to a half-day once a week (Royal Com., Q. 5213), the average allowed out daily at Fulham being eighteen, indicates a direction in which improvement is possible; and this, taken with the admirable precautions now insisted upon for disinfection, might render the conveyance of small-pox by these channels, at least a rare occurrence. We have only to read the pages of Mr. Makuna's most laborious and valuable "Examination of the Theory of Aerial Dissemination of Small-pox Infection" (*Medical Times*, 1884), to see how frequently hospital employés, workmen,

tradesmen, dustmen, and members of the non-resident staff have been the means of conveying infection from the hospital to a neighbouring street. It is, however, when we come to the patients themselves that the greatest risks are encountered. Who, for instance, can assess the mischief caused by a patient travelling by omnibus or tramcar, and the still more dangerous case of a patient going about for days in ignorance of the disease, or walking for miles through crowded thoroughfares to the hospital doors? (Five per cent. came to Stockwell on foot, and at Fulham as many as 20 in a single year).

In regard to the ambulances, I need only allude to the gross abuses which have been noted in the past—abuses which are put an end to, we may assume, by the well-considered and admirable arrangements which have been recently introduced by the Asylums Board. By such a system one pregnant source of infection round small-pox hospitals, though not necessarily along the ambulance routes, will have been practically abolished.

There remain the visitors, and these must ever be an unavoidable evil, attended with a certain amount of risk. In 1881, as we learn from the Report of the Medical Superintendent, 177 patients, dangerously ill at Fulham Hospital, were visited by 233 visitors, who paid 440 visits, and seven of these were subsequently admitted as patients to the wards; and Dr. Bridges asserts (Q. 644) that at Highgate Infirmary the spread round the hospital ceased when visitors were stopped. Much even here may be done to mitigate the danger, and if the simple plan advocated by Dr. Dudfield, of sending a daily bulletin of each patient to the friends, were adopted, the visiting would be reduced to a minimum. Simple inquiry by friends of the sick should certainly be possible without appreciable risk, beyond that arising from their own connection with infected neighbourhoods; while the imperfect disinfection of letters, and the incomplete convalescence of patients before their discharge, are mentioned only as actual sources of small-pox in the past; and with them I would close a very imperfect and hasty sketch of the influences silently at work in and around the small-pox hospitals of the metropolis, which have all been fertile sources of infection to an extent not always realised, and which, even under the most severe regulations and the most vigilant care, must entail a certain amount of risk to the healthy in the surrounding neighbourhood. If I have passed rapidly over these possible sources of danger, it is from no wish to minimise their importance, for each of them deserves and demands the

most serious and detailed consideration. I feel, however, that the defects brought to light by the Royal Commission are so palpable, and the improvements which may be made are so self-evident, that if these had been the only sources, real or suspected, of small-pox spread, you might still be in possession of the 1,054 beds for the disease on which Sir Edmund Currie prided himself in 1882 ; for it cannot be supposed that obstacles so successfully surmounted in our large provincial towns would prove insuperable when met with, aggravated possibly, but essentially the same, in the crowded centres of population in London. It is well known, however, that a theory has been propounded—for as yet it is nothing more—that a subtle, far-reaching, and intractable mode of infection has been exercising its influence round the centres of small-pox isolation ; that silently and surely through the still air, or the fog, in the direction of the wind or even against it, the particulate matter of small-pox has been and is being wafted, like "the scent of flowers, of the hay field, or of the sea", to distances of a mile or a mile and a half, still powerful for infection, and capable of starting the disease afresh in the most unexpected quarters. The mere possibility of such a danger—for it was not held to be proved—was a sufficient reason in the minds of the Royal Commissioners for reducing the number of small-pox beds to 40 or 50 in the *Fever Hospitals* (called "Small-pox" Hospitals no longer) of the Asylums Board. It could scarcely be expected, even by its most strenuous supporters, that a theory so startling, and so contradictory to all previous experience, would be accepted, save on the most clear and convincing evidence; I propose, therefore, this evening to weigh such facts as have been brought forward in its support, as well as the difficulties which, in my own mind, seem so far to preclude its acceptance. That small-pox has shown a tendency during the epidemics of the last ten years to extend widely in the neighbourhood of small-pox hospitals in London, is now, I suppose, an acknowledged fact ; but it must at the same time be borne in mind that the neighbourhoods of some of these buildings were already the familiar homes of the disease before the hospitals were opened (*Makuna*, p. 11 ; *Collie*, Q. 2045), and that their surroundings are usually such as to favour the rapid extension of the disease when once it is introduced among the people. Courts and houses crowded and ill-drained, constant change of residence, frequency of intercourse among the inhabitants, imperfect vaccination, ignorance of all sanitary conditions and of the nature of disease, with often a strong ten-

dency to concealment of the evil when recognised or suspected,—such are a few of the conditions favouring the spread of the disease, not round small-pox hospitals only, but wherever the poorer classes are congregated; and it is among this inflammable material that we have to trace the spark which lights up the conflagration. The difficulties are immense, so great indeed as to lead one to doubt whether the question can be solved amongst such masses; but here we are met with the unexpected difficulty that the behaviour of small-pox, *quâ* infection, is supposed to differ in London and in the provinces; for whereas Dr. Thorne Thorne, in his very able Report on "The Use and Influence of Hospitals for Infectious Disease", could, out of 70 hospitals which he examined, point to two instances only (both houses in a row and utterly unsuited to the purpose) in which small-pox had been suspected to spread from a hospital in the provincial towns—in London, even in such a locality as Hampstead, small-pox, according to Mr. Power and other upholders of the theory of "distal aerial infection", the particulate matter of small-pox, may, under varying conditions of population, of atmosphere, and aggregation of cases, be carried through the air to a distance of a mile or a mile and a half. Our evidence, therefore, must be drawn from London alone; and on this we shall have to decide whether the spread observed round the small-pox hospitals has been due to causes which are preventable, or to such as are more or less beyond our control,—whether, in short, it proceeds from the recognised channels of small-pox infection, favoured possibly by remissness or imperfect arrangements in the past, or whether it is carried for long distances through the atmosphere and disseminated among the surrounding population. Now, a very slight acquaintance with the small-pox literature of the metropolis is sufficient to show the immense facilities which have existed for the extension of this disease round the hospitals devoted to its treatment; so great that, as Mr. Forshall tells us (Royal Com., Q. 3348), as many as 60 per cent. of the cases round Highgate could be traced to personal communication with the hospital; and Dr. Tripe, in his Report for 1880 (pp. 14-16, and Royal Com., Q. 576), contrasts the immunity of houses within a few feet of presumably well-managed small-pox hospitals, such as Mrs. Gladstone's at Brook Road, and an iron hospital adjoining Brook Road, where there was but little visiting, with the excessive spread round Homerton,—the excess round the latter, he then thought, being sufficiently accounted for by the malconstruction and defective operations of the hospital

itself. Air flowing from a small hospital (the instance taken held 50 beds) could not, in his opinion, carry infection beyond 40 or 50 feet, whereas a hospital containing say 130 or 150 mixed cases should for safety be 90 feet from an inhabited house or footpath.

Dr. Tripe has, I am aware, changed his opinion, but it is, nevertheless, worth noting that in 1881 he did not consider it necessary to invoke extraordinary channels of infection to account for the increased prevalence of small-pox noted in the vicinity of the hospital. Dr. Dudfield also has seen no difficulty thus far in believing that the undue incidence of disease which he acknowledges to have existed round Fulham Hospital may be explained by ordinary personal communication or other modes of convection. I do not know the present views of Dr. Bristowe on this question, but in his memorandum on the prevalence of small-pox in the parish of Camberwell, there is no allusion to dissemination through the air; at the same time the hospital is shown to have had a considerable influence on the incidence of small-pox in its neighbourhood. It is worth noting, however, that the tables prepared by Dr. Bristowe point to an exaggeration of existing evils rather than to any new influence introduced by the hospital for No. 4 Ward; and Peckham district exhibited a special liability to the disease, not only when the hospital was in full operation, but before it was opened, and at a period in 1877-8 when it did not receive small-pox patients.

Mr. Power, in his well-known Report on Fulham, in 1881, felt constrained to arrive at a different opinion from that held by Dr. Dudfield, by Dr. Barclay, then Medical Officer of Health for Chelsea, Dr. Collie, and others, and I must occupy your attention for a few minutes with the grounds on which his conclusions are based. With a view to ascertaining the comparative incidence of the disease at varying distances, circles were described, with the Small-pox Hospital as a centre, at distances of a quarter, half, and one mile, thus forming four zones or rings, the whole of which were comprised in what he described as "the special area". From an inquiry, necessarily very incomplete, but extending over the epidemics of 1876-7, 1878, 1878-9, 1880, and 1881, Mr. Power found that there was in each an excessive incidence of small-pox in the neighbourhood of the hospital as compared with that at a distance, "the graduation in intensity being such as almost to suggest the existence of a natural law." Now, at first glance, this would appear to be a strong presumptive case against the hospital; but a very slight examination

of the facts will suffice to show that such simple arithemetic is quite inadmissible; for the areas or rings are so dissimilar as regards class of houses, social position of inhabitants, etc., as to be quite unfit for comparison; and the immunity of mansions and better-class houses in the outer rings may be no more due to their distance from an infective centre than the greater prevalence of the disease in the poorer and more crowded tenements of the quarter or half-mile rings to their proximity. The same observations would, I think, apply in principle, though perhaps in different degree, to the tables prepared by Dr. Tripe, to show the graduated intensity of small-pox round Homerton in the outburst of March, in last year. A mere graduated intensity may, in itself, be no proof as against a small-pox hospital; and this becomes more apparent when the cases enumerated by Mr. Power are minutely examined, for he has taken each freshly invaded house as a case against the hospital, ignoring influences ten times more potent beyond the hospital walls —influences which spread infection from house to house with the greatest rapidity, and not seldom give rise to 20, 30, or even as Dr. Tripe himself has recorded (Report, 1880, p. 21), 52 patients deriving their origin from the single original case.

It is the first case alone of any group or series which can be fairly used in such a method of inquiry, and then only if all other means to account for it have failed; at the best it could but be presumptive evidence of aerial spread from the hospital, for who would be bold enough to say that all the subtle ways of infection had been satisfactorily eliminated in a given case of the disease? There is yet another fallacy contained in Mr. Power's table showing the incidence of disease round Fulham Hospital, for he combines the cases occurring in the three parishes of Kensington, Chelsea, and Fulham, and thus conceals the important fact that these occurred, as Mr. Makuna has shown (*cf.* also Bostock, evidence, Royal Com., Q. 1265), in very unequal proportions and at very different times, the disease being most prevalent in Fulham when it was least so in Kensington and Chelsea, and *vice versâ:* a mode of distribution not easily reconciled with the supposed dissemination of aerially contained matters in all directions from the hospital as a centre (Power, R., p. 330).

Pursuing his inquiry still further, Mr. Power was struck by an apparent connection between the number of small-pox cases occurring round the hospital, and the number of acute cases under treatment in the wards; but a closer examination of the figures somewhat shakes our faith in the conclusions at which he arrives, for,

apart from the fact that admissions to a small-pox hospital would materially increase with the extension of the disease in the neighbourhood, in the year 1878, during the fortnight succeeding the largest admission of cases (viz., 115 on April 20th), when their influence would presumably be most marked, the invasions over the special area fell from 49 to 23, whilst in 1878-9, and again in 1881, when the first decided increase in newly invaded houses over the "special area" took place, there were not 20 acute cases in the hospital; and Dr. Dudfield has shown, in his Report on the Epidemic of 1881, that there was no relation between the numbers in hospital and the number of cases in Kensington, and especially that for several months while the hospital was receiving patients there was not a case in the street which, more than any other in Kensington, is cited in support of the "distal aerial theory" (Ifield Road). The same anomalies presented themselves to Dr. Gwynn at Hampstead, who considered that the number of houses invaded had nothing to do with the varying numbers in the hospital; and to Dr. Tripe, at Homerton, who having found that overcrowding of the hospital had done little harm, whereas a notable outburst had taken place round the hospital when it contained but 28 cases, is inclined to lay little or no stress on the numbers charging the air, as supposed by Mr. Power, with infectious matter, but would rather look for the cause in some conditions of atmosphere as yet unknown, or but very imperfectly understood. Now, I have shown elsewhere (*Lancet*, February and June 1884), as regards Fulham Hospital, that in each of the five epidemics under review, small-pox had spread in a great wave from east to west, and that the ebb and flow of the disease in Mr. Power's "special area", notably in 1878, 1880, and 1881, showed a synchronism so remarkable and absolute with the rise and fall in the cases occurring in London generally, as to afford more than a suspicion that the tides which Mr. Power was watching so intently on the Fulham shore, were due, not so much to the action of winds or local influence, as to some wider overruling force, corresponding to the moon's attraction on the waters of the sea.*

The outbursts, too, on which Mr. Power and Dr. Tripe, and, I may add, Dr. Gwynn, lay such stress, are found on examination to be so small as to be worthless for statistical purposes. Thus, in 1880,

* The epidemic of 1884 shows the same characteristics. Commencing round Hackney, where it had lingered through 1883, it spread in a wave over the metropolis; and, with the one exception of Homerton, the largest entry of cases in all the hospitals took place in the fortnight ending June 20th.

when 14, the highest number of fresh invasions within a fortnight, were reported in Mr. Power's "special area", 2 only of these occurred in the quarter-mile ring with its 432 houses, 7 among the 3,448 houses of the quarter to half-mile ring, 2 among the 4,224 houses of the half to three-quarter mile ring, and 3 among the 3,569 houses of the three-quarter to one mile ring: numbers scarcely sufficient, one would think, to require a new theory for their explanation. And so with Dr. Tripe's outburst of 66 in his "special area" round Homerton in last year. In the quarter-mile ring, with a population of 10,000 poor, there were on March 21st, four; on the 22nd, one; on the 23rd and 24th, four; and on the 25th and 26th, eight houses freshly invaded by small-pox, a circumstance which could probably be equalled or surpassed in many districts with 10,000 inhabitants, and in which there is no such *deus ex machina* as a small-pox hospital on which to lay the blame. In the half-mile ring, with 30,000 inhabitants, the incidence on the six days was 1, 5, 5, 4; on the half-mile to one mile, with 60,000, it was 2, 2, 7, 3; and outside, with its vague population of 100,000, it was 2, 3, 5, 4. In the outbreak recorded by Dr. Gwynn the facts are difficult to trace without an intimate knowledge of the locality, but the spot map shows an extension of the disease within the quarter-mile circle to the eastward, whereas the prevailing winds are said to have been N.E. and E.S.E.; the infection would thus have gone up the wind, as in Dr. Tripe's case. Again, it is puzzling, on any theory of distal aerial spread, that in the first three weeks of the epidemic, June 7th to June 21st, the houses newly invaded in the quarter-mile should be 3, 2, 1, a total of 6; whereas in the half-mile circle, and further removed from the hospital, they should be 3, 6, 4, or a total of 13; and, in contrast to Mr. Power's observation, a fortnight after the admission of 44 new cases, the invasions in the special area were *nil*, and this at the commencement of an epidemic, Mr. Power's period of danger; whereas in September there was a notable increase of invasions when there were five patients only in the hospital at the infective period.

The distribution in time, also, of the cases occurring in Mr. Power's "special area" seems difficult to explain by his theory of aerial dissemination. It points rather to some continuous agency, such as the ordinary spread of small-pox in epidemic periods among a crowded population. Thus, in 1876-7, from March to the close of the year, 15 invasions only of the 130 reported in the "special area" were in the quarter-mile ring, and of these generally one, and never more than two, occurred in a single fortnight; again, in 1878-9, of the 97 houses

invaded in the "special area", 19 only were in the quarter-mile ring, spread evenly over the year from January to September, and never on any occasion exceeding three in the fortnight. The importance of the evidence collected by Mr. Power concerning the epidemics previous to that of 1881 may be judged from the candid admission of Mr. Power himself, that although some hitherto unrecognised factor of epidemic small-pox had probably been in operation at the time of the great outburst of 1881, there was no direct evidence that the hospital had been such factor; and that "unless it could be shown that in other years, during which the hospital was in use for small-pox, there had been exceptional incidence of the disease on the 'special area' around it, occasion for believing the hospital to have been concerned in the outbreak of 1881 did not necessarily arise."

There are, however, some special points in this outburst of 1881 which must not be passed over in silence. Mr. Power was not only impressed by the graduated intensity of the disease and its relation to the hospital operations, he was struck also by the symmetry of the spread in all directions, the small number of cases accounted for, and the peculiar fitness of the atmosphere at the infective period of the outburst for the dissemination of infectious particles through the air. Now it might reasonably be expected, on any theory of distal aerial dissemination, that evidence drawn from various sources should at the least not be contradictory; yet we find that at Fulham in 1881 the infection is spread equally in all directions, "during a period of severe frost, characterised by still, sometimes foggy weather, with occasional light airs from all points of the compass", and when there was no ozone in the air; whereas, in another outburst, also at Fulham, in April 1878, the atmosphere was clear, not foggy, with wind moving 90 miles per diem in excess of the average, and a temperature 18 degrees higher than it was in 1881, with abundance of ozone; and, as if these were not sufficiently striking, we have Dr. Gwynn asserting that at Hampstead the wind blew from the hospital to the houses attacked; and an explicit statement from Dr. Tripe that at Homerton, in last year, the aerial spread which he suspects did not extend symmetrically, did not extend in calm or in fog or in the absence of ozone, nor yet in the direction of the wind, but as it were in its very teeth. Contradictions such as these may well make us doubt whether atmospheric conditions after all have been a factor in the case.

As regards symmetrical spread, it would in itself have little weight even if it existed, but it has been decisively shown by Dr. Dudfield

and by Mr. Makuna that no such symmetry existed at Fulham; there is certainly no symmetry in the Hampstead outbreak; and Dr. Tripe's cases at Homerton spread in a W.S.W. direction from the hospital. Whole streets and crowded institutions, not only round Fulham, but at Homerton and Stockwell, with soil ripe for any infectious seed, were mysteriously passed over by the "particulate matter",* whilst others far beyond were as mysteriously attacked by it. The grouping of cases, too, in such spot maps as I have had the opportunity of studying, seems to denote a spread from several smaller foci of disease rather than from a single centre; whilst the large number of domestic servants attacked is conclusive, as Dr. Dudfield has pointed out, that other influences were active in spreading disease round Fulham, which Mr. Power wholly failed to appreciate at their true value. There are no doubt cases in every epidemic, the origin of which cannot by any ingenuity of questioning or reasoning be explained; their number is variously assessed, but it has not been shown, so far as I am aware, that there is a gradation in the intensity of such cases when they occur round small-pox hospitals; and the absurd simplicity of the origin in some mysterious outburst of the disease, when the key has at last been found, must be familiar to all who have interested themselves in the ways of infection. The sick-room of the concealed patient opening straight upon the bar of the public-house or the shop counter; clothes infected at the journeyman tailor's, sent home to the fashionable shop and thence to the customer's house; clothes washed by a laundress, who is nursing cases of the disease; private houses visited by the wife of a patient in search of refuse and waste; an infected patient walking at large, —such channels as these, and they are drawn from the life, *may* be quite untraceable; are we therefore at once to assume an aerial connection in such cases with the nearest small-pox hospital? Such is apparently the contention of those who uphold the theory of distal aerial dissemination of small-pox poison. Mr. Power could trace 9 only out of 32 cases in the special area; Dr. Dudfield was more fortunate in tracing 26 out of 41, the average being 50 per cent., whether in the neighbourhood of a small-pox hospital or removed from its influence; others have been impressed by special instances occurring under circumstances which seem to preclude the possibility

* Dr. Tripe, in his evidence "Fleet *v.* Asylums Board", advances the novel doctrine that the infectious matter had struck the walls of the City of London Workhouse, and leaving its inmates unharmed, had been carried over and "plumped down" on streets beyond.

of personal infection (Tripe, Report, 1883, p. 27), in asylums, for instance, or refuges; but even such institutions, however isolated, are approachable by infected milk or clothing, or even by persons who may convey the disease. Dr. Gwynn mentions a butler who caught the disease though he had *hardly* been out for three weeks previously.

I would now venture to put a plain question to those who have followed the course of reasoning pursued in my paper, it is this. Given a case of small-pox in a crowded court within, say, a mile of a small-pox hospital in London, and for the origin of which our most stringent inquiry has failed to account; whether is it easier to suppose that the particulate matter of small-pox has been wafted for a mile, passing over some hundreds of susceptible individuals in its flight, to alight just where we have found it—or to confess that our means of research may have been baffled by some of the innumerable modes of small-pox spread by simple convection, in clothing, or in food, or by ordinary human agency? The spread of small-pox in a dense neighbourhood is so rapid, so eccentric in its course, as to foil the closest scrutiny. Unrecorded cases, concealed cases, mistaken cases, and cases of exposure abound; it is only now and then that the Health Officer, having found the clue and followed it with the assiduity of a sleuth-hound, has been successful in tracing 18 cases to one in a public-house; or as at Deptford, a large outburst to an Irish wake (Q. 700), or as many as 52 to a single child retained at home in place of being sent to the hospital—a foretaste surely of the fate of denser London, if institutions which have done such good work in the past are to be permanently cramped and crippled in their usefulness, or alienated from their original purpose.

Much more might be advanced, but my allotted time is spent. It has been shown, however, as I think, that in spite of assertions showing a confidence which has somewhat outrun the facts, we may be allowed to doubt the aerial dissemination of small-pox infection to a mile and a half, a mile, or even quarter of a mile; and as a corollary, to doubt also if small-pox hospitals in the metropolis *per se*, and independently of their incomings and outgoings, are necessarily sources of danger to the surrounding populations.

II.

By EDMUND GWYNN, M.D.,
Medical Officer of Health to Hampstead.

When the managers of the Asylums Board announced their intention of acting on the lines laid down by the Royal Commissioners in their Report on Small-pox and Fever Hospitals, namely, that a few small wards, capable of accommodating from thirty to forty of the more severe cases of small-pox, should be maintained within the precincts of the Fever Hospitals, it was felt that an experiment under somewhat novel conditions was about to be tried. For in the previous twelve years, during which the Asylums Board had treated vast number of small-pox cases in a few large hospitals, abundant proof had accumulated, that by some means or other a large increase of small-pox had taken place in the immediate neighbourhood of these hospitals. That a small-pox hospital under any circumstances and however carefully managed could be placed in the vicinity of a crowded neighbourhood without danger to the inhabitants was, indeed, a question upon which independent authorities of the very highest rank did not agree. We find Sir W. Jenner stating before the Royal Commission, "I hold it to be most unjustifiable to place a hospital for small-pox in any crowded neighbourhood. I should think it a most dangerous thing to do."

The position held by the Hampstead Small-pox Hospital in the controversy was so far peculiar and different from that held by any other small-pox hospital in the metropolis, by reason of the hospital having been closed during certain periods when small-pox was rife in London, and by having been open during other periods when that disease was prevalent. An opportunity was thus afforded of testing the various explanations offered, that causes independent of the presence of the hospital would account for the spread and concentration of small-pox in its immediate vicinity.

Prior to 1870, Hampstead had enjoyed remarkable freedom from small-pox, and when the hospital for small-pox was opened on December 10th of that year, no case of that disease was known in the parish. Before the closing of the hospital in 1872, 67 houses had been invaded within 300 yards' radius of the hospital, and on its western side all houses lying between it and Haverstock Hill, with one exception, were attacked. Again, in the epidemic of 1876-8, the hospital was opened, and again the disease concentrated itself in

houses immediately adjoining it. But in the epidemic of 1881, the Hampstead Hospital was closed; whilst the streets and houses in the vicinity of the hospital, which had on former occasions borne the brunt of the disease, were almost entirely free from small-pox.

The death-rate from small-pox during the periods mentioned points to the same conclusion, for we find that whereas the deaths of Hampstead parishioners per 1,000 to the total London deaths from small-pox in the epidemics of 1871-2, 1876-78, rose to 7.4 with the hospital open, it fell to 2.1 in 1880-1 with the hospital closed.

I pass on from these preliminary statements, which have now become matters of history, to the more immediate question before us,—What has been the effect on the surrounding neighbourhood of a small-pox hospital with a limited number of cases?

The Hampstead Small-pox Hospital was again opened on April 6th, 1884, the admissions during the first week being seventeen. The largest number of admissions in any one week was forty-four, and the largest number of patients remaining at the end of any week twenty-six. In some weeks the admissions fell to seven and eleven; and the number of inmates of the hospital at the end of the week on two occasions fell to five.

Previously to the opening of the hospital four cases of small-pox were known to have occurred in the parish, but these, with one exception, took place at great distances from the hospital; whilst the one in the vicinity of the hospital occurred three months before the opening of that building, and no spread of disease took place from it.

It was not until the hospital had been opened some three or four weeks that the disease sprang into activity, and the houses around the hospital were not the first attacked. The disease appeared in great activity in the district of Belsize at this time, and I have a record of a group of ten houses, invaded in the first two early weeks in June, many of which were mansions standing in their own grounds, and where not the slightest history of contagion could be traced. The distance of this group of houses would be between a quarter and half a mile radius from the hospital, and during the period they would receive their infection, *i.e.*, the two latter weeks in May and first week in June, the wind blew steadily from the N.E. and S.S.E., that is to say, in a direct line from the hospital wards across a district almost entirely open. Two cases in this group were treated at home, but as the characteristic rash appeared on the 3rd and 7th of June respectively, their presence cannot account for the outbreak; in fact, it may fairly be assumed that they themselves were victims of some

common cause. After the first week in June, the number of houses invaded within a quarter-mile circle from the hospital continued to rise steadily in proportion to the other houses in the parish, until at the end of eight months the number of infected houses in the quarter-mile circle, containing 310 houses, rose to 62, against 134 infected houses out of a total of 6,870 houses.

Number of Houses invaded in Hampstead from May to December 1884. Hospital open.

In all Parish (6,870 houses).	In a Quarter-Mile Circle from Hospital Wards (310 houses).	Between Quarter- and Half-Mile Circle from Hospital Wards.	Quarter-Mile Circle from Workhouse (1,037 houses).
134	62	24	16

I proceed to compare this incidence on houses round the hospital with that which occurred during the far more fatal epidemic of 1881.

Number of Houses invaded in Hampstead from January 1st to December 31st, 1881. Hospital closed.

In all Parish (6,151 houses).	Quarter-Mile Circle from Hospital Wards (267 houses).	Between Quarter- and Half-Mile Circle from Hospital Wards.	Quarter-Mile Circle from Workhouse (1,037 houses).
36	4	8	6

Incidence of Small-pox on Houses during two periods. Rates per 100 Houses in each Area referred to.

Epidemic Period.	Whole of Parish.	Special Area within One Quarter-Mile Radius from Hospital Wards.	Quarter-Mile Radius round Workhouse.
Epidemic of 1881. Twelve Months Hospital closed.	.58	1.5	.57
Epidemic of 1884. Eight Months Hospital open.	1.9	20.9	1.5

Thus, whilst the total number of houses infected in the whole parish has increased but four-fold over the former epidemic, when the hospital was closed, that in the special area has increased fifteen times during the present epidemic.

The deaths from small-pox of Hampstead parishioners also show a considerable rise over those of the epidemic of 1880-1; thus, whilst the proportion per 1,000 to total deaths in 1880-1 was 2.1 when the hospital was closed, it has risen during the present epidemic to 15.31, with the hospital open.

As in former epidemics, the cases are found to group themselves around three centres: the first, and by far the largest, around the hospital; the second, in the squalid quarters around the workhouse; and the third, in the densely populated districts of Kilburn. But if we turn to the epidemic of 1881, we find that whilst the groups around the workhouse and the Kilburn district are constant, that around the closed hospital is absent, the quarter-mile ring showing but four cases, not one of which is in the Fleet or Lorne Roads. Yet the character of the neighbourhood around the hospital remains the same as in 1881, and may even be said to have improved, by reason of the attention paid in these last years to sanitary requirements.

If the various explanations offered to account for the spread of the disease in this neighbourhood, by concealed cases, by overcrowding, by the natural march of the epidemic from east to west, or from south to north, are to be accepted as satisfactorily accounting for the concentration of cases around the hospital during three epidemics during which the hospital was open, why, may we ask, did the disease almost absent itself from this particular quarter during an epidemical period when the hospital was closed?

That the danger to the neighbourhood does not depend upon the number of cases contained in the hospital is, I consider, shown by our Hampstead experience, the varying numbers in the hospital seeming little to agree with the weekly number of houses invaded. As a matter of fact, many of the cases admitted in the early summer months being slight, they, together with the convalescent patients, were immediately forwarded on to the hospital ships or to the camp at Darenth. It can hardly, however, be considered that the movement of so many patients to and from the hospital, even if they did not remain inmates, could be effected without risk to the neighbourhood.

Does, then, the danger arise through personal communication, or

is it caused by the passage of ambulances through the streets; by sewer communications; or, after all, may it not depend upon aerial dissemination?

Personal communications, by nurses, officers of the hospital, visitors of the sick, by tradesmen, etc., were all strictly guarded against at Hampstead by excellent regulations, carried out, I am informed, with due attention.

Ambulances, in their old form at least, may be considered as moving hospitals, freely distributing small-pox infection. It is gratifying to find that the Asylums Board have recently adopted the improved ambulance of Dr. Gayton, which is calculated to minimise as much as possible the danger of communicating small-pox during the conveyance of patients through the streets.

In the epidemic of 1870-1876, on account of a barrier erected in Fleet Road by the owner, the only entrance to the Hampstead Hospital was by Haverstock Hill, situated on the west side. Yet the disease concentrated itself most thickly on the east side, where no ambulances would come, except to remove cases. The entrance to the hospital during the present epidemic, by reason of the barrier having been removed, has been in the Fleet Road, or east side, and the ambulances would approach from St. Pancras mostly; yet the disease spread most rapidly in the first instance on the west side of the hospital.

At first sight it appeared that the sewer, in this instance the Fleet ditch or sewer, might offer an explanation, for, on all three occasions when the hospital was open, the disease has spread along that line of sewer; but in the present instance we are met with the difficulty that the cases on the continued line of sewer, on the higher ground beyond the hospital, have not been numerous, whilst it is a well-known fact that the upward flow of sewer gas in the Fleet sewer to the higher ground above is, at times, very great.

The condition of the populace with regard to vaccination must be considered. The returns of the Hampstead Vaccination Officer compare favourably with other parts of London; and house-to-house visitation for the purpose of inducing re-vaccination was duly carried out, with, however, but moderate results. The wonderful philosophical patience of the poor, and their spirit of fatalism born of ignorance, and absence of enlightenment, offer a barrier to re-vaccination against which all argument must beat in vain. Aerial dissemination remains—a subject, indeed, pregnant with difficulties, but which, after all, will, under the present circumstances of our knowledge, alone account for facts not otherwise to be explained.

At the distant, or north-east side of the Hampstead Hospital, are certain brickfields, the emanations from which are most offensive. These fumes, after sweeping over the hospital and up the gentle hill leading to Belsize, are often more perceptible in that quarter than in the brickfields themselves. During the period when the outbreak of small-pox occurred in Belsize, the complaints received of the nuisance from these brickfields became so numerous from the householders in Belsize, that the Vestry was induced to commence legal proceedings to stop the annoyance.

If, therefore, chemical fumes from two burning clamps could, as alleged, cause sickness and faintness at a distance of a third of a mile, no difficulty need be felt in supposing that infectious material from the hospital might travel by the same means in the same direction, especially as the lofty and open windows on both sides of the hospital wards offer every facility for the easy escape of infected particles.

The presence of a small-pox hospital in active working order may be compared to the fountain-head of a river. However small it may be, still it is constant; and as a river will never entirely dry up and disappear whilst the fountain-head or spring flows, so all efforts to stamp out and control an epidemic of small-pox are rendered futile whilst the hospital, in its present form at least, remains.

III.

By J. W. TRIPE, M.D., M.R.C.P.E., F.R.Met.Soc., etc.,

Medical Officer of Health to Hackney.

Although the title of my Paper is "Are Small-pox Hospitals necessarily *(per se)* a Source of Danger to the Surrounding Population?" I have had no doubt for some time past that the Small-pox Hospital at Homerton has been a source of infection to the surrounding neighbourhood, and lately, that the infection has extended directly through the air to a rather considerable distance. If it be admitted that the infective matter of this disease can be carried for twenty or thirty yards—and a large proportion of those who have paid any attention to the subject admit this—I cannot see any reason why, under favourable atmospheric conditions,

including a low velocity of the wind, it should not cause the disease at a much greater distance. No one, I believe, assumes that infective matter can be destroyed by the air, *i.e.*, oxydised, in a few minutes, or even in an hour, as experience shows that under favourable conditions it may retain its vitality for months. I use the term vitality advisedly, as I do not believe that dead matter can produce the phenomena which are observed in a case of small-pox, scarlet-fever, or measles. It seems to me as illogical to say that this disease can spread through the air only to a certain definite distance, as that the height to which an ordinary pump can draw up water, or quicksilver rise in a vacuum tube, can be explained by the old theory "that nature abhors a vacuum" up to a certain height in each case and no further. I can understand those who assert that infectious matter cannot pass through the air at all, and that the disease spreads only by direct contact; but not the others, unless it be assumed that a certain dose of the infectious matter is necessary to induce the disease.

The chief difficulty as regards the spread of small-pox from a hospital is to assign the particular manner in which the disease is spread, as I think nearly all who have had any experience of a small-pox hospital, as ordinarily conducted, will admit that it does act as a centre of infection in crowded neighbourhoods. At the termination of the epidemic of 1870-71, I was fully persuaded of this, and as time has rolled on I have become more certain of it; but as there were certain very objectionable arrangements at the Homerton Hospital, which, in my opinion, aggravated the evil, I could not, and cannot even now, give any opinion as to its injuriousness if properly constructed and conducted. The objectionable arrangements there are now in the course of removal, and I trust that Hackney will not continue to suffer in the future as it has done in the past. It may be said that, in stating thus early my opinion before the facts are laid before you, I am begging the question; but I do so because I do not believe that the hospital need to have been so injurious as it has been.

Before the managers of the Metropolitan Asylums Board built these hospitals, scarlet-fever was, I think, believed to be the most infectious of all the eruptive fevers, but experience has shown that small-pox occupies this position. The modes by which the infection spreads may be briefly stated as being by the intermixture with the outside world of persons who have come from the hospitals,

or from other infected places ; by ambulances ; by infected clothing; by persons suffering from the disease; and, as I believe, by the air carrying the infection to a greater or lesser distance to uninfected localities. The great difficulty is to divide the effects produced by what is ordinarily termed personal, as contradistinguished from aerial infection; and I shall, therefore, endeavour to show in the first place the influence of all causes combined on the public health of the inhabitants of Hackney, and subsequently attempt to show that aerial infection is not a myth but a certainty.

The Homerton Hospital is bounded by an extensive space of open ground on the east and north-east, and when it was erected, on the north also ; but the latter has been completely built over, and houses are also now being erected on part of the ground to the east and north-east. I therefore omitted in my account of the incidence of the disease for the years 1871-80 the inhabitants of the quarter-mile radius residing on the north of the hospital, and confined my statistics for these years to the streets situated on the south and west, and to one street on the east called Brooksby's Walk. As regards the epidemics of 1880-81 and 1883-84, I have included the whole of the inhabitants, as the ground on the north is covered with houses.

In my report on the epidemic of 1870-71, I stated that in the streets immediately adjoining the hospital no less than 110 cases were reported to me amongst 1,492 inhabitants residing in 243 houses, whilst there were only 703 cases reported amongst 30,177 persons residing in other streets occupied by a similar class of people. That in other localities where the disease was most prevalent there were 45 cases per 1,000 inhabitants against 173 in the streets around the hospital. It is true that before the hospital was opened the disease had taken root in Hackney; but it was not epidemic near the hospital, single cases only having occurred in each street, whilst two localities, at a distance from the hospital, had suffered very severely. When the hospital had been open for a month a great change occurred, as during the following weeks as many as 74 cases were reported to me from the quarter-mile radius, against 312 in all other parts of the district. As there were at that time 124,000 inhabitants in the whole district, and less than 7,000 in the quarter-mile radius, the excessive incidence of the disease in this locality is very striking. During the fortnight ending June 29th there were 23 cases, and in the next fortnight 17, within the quarter-mile radius, making 40 cases in four weeks, against 160 in the other parts of the district. These

numbers, without further enumeration, show the excessive prevalence of small-pox in the quarter-mile radius during 1871.

The next epidemic commenced in Hackney in October 1876, some sporadic cases having occurred in that month in various parts of the district; but there was not any marked localisation of the disease until the 30th, when there was a severe outbreak in Homerton, South Hackney, and Hackney Wick, which are chiefly to the south or south-east of the hospital, but a few to the south-west. By the end of the year I had received notice of 506 cases, of which 61 occurred on the Clapton Park Estate, 65 in Hackney Wick, and 165 in Homerton, chiefly in the vicinity of the hospital. During the next three months there were 321 additional cases, making a total of 827 cases; of which 261 occurred in Homerton, 127 in Clapton, chiefly on the Clapton Park Estate, 114 in South Hackney: making a total of 502 cases in the localities nearest to the hospital, and 93 cases at Hackney Wick; or more than 70 per cent. of the whole number in the district. In 1879, small-pox had so much diminished in the metropolis, that the hospital was closed on September 29th until February 8th, 1880; and, during the whole of this time, although cases occurred elsewhere, only two were reported near the hospital in October, viz., one in Brooksby's Walk—the child of a woman who had been attacked with the disease in the same house in September—and the other in Churchill Road. A month after the hospital was opened, the disease became epidemic in the streets near it, 40 cases having been reported to me in 1880, out of 363 in the whole district. There were also numerous other cases within the quarter-mile district to the north of the hospital, as the total number of cases reported to me between October 1, 1881, and September 30, 1882, was 1,271; and of these, 220 happened in the quarter-mile radius (including all the houses within this circle), 382 between the quarter and half-mile radii, and 669 in the remainder of the district. The number of houses in the quarter-mile radius in 1881 was 1,750; in the space between the quarter and half-mile radii, 4,026; and outside, 21,724; or at the rate of 126 cases per 1,000 houses in the quarter mile, 95 between the quarter and half-mile radii, and only 31 per 1,000 outside this circle. As this last number includes a large proportion of cases between the half-mile and one-mile radii, this contrast is the more striking. During the epidemic of 1883-84 (October 1st, 1883, to September 30th, 1884), to which I shall more especially refer, there were 1,211 cases reported, of which 278 occurred in the quarter-mile radius, 410 between the

quarter and half-mile radii, and 523 outside. Of these, 310 happened between the half-mile and one-mile radii, making a total of 998 cases out of the 1211 within the one-mile radius. The streets in the quarter-mile radius were most severely affected, as there were 158 cases per 1,000 houses there, against 92 between the quarter and half-mile radii, and only 22 outside the half-mile radius.

A summary of the incidence of the disease during 1871-80 gave similar results, but I was compelled to treat the statistics in a different manner, and to consider deaths only. In the streets immediately adjacent to the hospital, which contained on an average about 2,236 persons, living in 306 houses, there were 95 deaths (not cases), giving the enormous mortality of 4.13 deaths per 1,000 population per annum; whilst in all the houses to the south of, and at the sides of the hospital, containing on an average 6,823 persons, the mortality was 2.42 per 1,000. In houses occupied by above 30,000 persons, of a class similar to those living within the quarter-mile radius, there were 484 deaths in the ten years, or 1.61 deaths per 1,000 population per annum, against 265 deaths amongst the 119,400 better-class population. The death-rate from this disease was therefore only 0.22 per 1,000 among the better-class population living at some distance from the hospital, against 4.13 amongst those living near it. Of course I do not attribute anything like the whole of this enormous difference to the presence of the hospital, as comparative overcrowding, imperfect vaccination, and different social habits must have exercised a very prejudical influence amongst them; but I think that most, if not all, of the difference between the annual mortality of 4.13 and 1.61 amongst other poor may be attributed to the hospital.

The number of deaths in 1883-4 registered in Hackney, and of Hackney cases in the ships and at Darenth, was 125 : a much smaller number than in 1881 (when 225 deaths were registered), although the number of cases was nearly as large as in the latter year, and somewhat smaller than in 1877. The deaths occurred as follows : 42 amongst patients in the quarter-mile radius, 44 within the quarter and half-mile radii, and only 39 outside the half-mile radius.

The following Table shows the chief statistical facts connected with the outbreak.

HACKNEY.—*Percentages of Cases and of Deaths from Small-pox in different radii.*

1883-84.	Cases.	Deaths.	Houses.
Quarter-mile . . .	22.9	33.6	6.1
Between Quarter- and half-mile radii	33.9	35.2	14.7
Totals . . .	56.8	68.8	20.8
Outside half-mile radius . .	43.2	31.2	76.9
	100	100	100
Between half mile and mile radii .	25.0	16.8	

As the 125 deaths include those of all the inhabitants, a comparison between the percentages of houses and of deaths affords a fairly reliable estimate of the prevalence of the disease in different parts of the district, although it is evident from the percentages of cases in the different radii that the disease was more fatal amongst the inhabitants of the quarter-mile radius than elsewhere. Thus, there were 22.9 per cent. of the total cases, and 33.6 per cent. of the total deaths, amongst its inhabitants. The contrast between 33.6 per cent. of all the deaths from small-pox, and 22.9 per cent. of the cases, against 6.1 per cent. of the whole number of houses, is very marked, and fully bears out the conclusions drawn from the deaths during 1871-80. The table also shows that 33.9 per cent. of all the cases reported to me, and 35.2 per cent. of all the deaths, occurred between the quarter and half-mile radii, whilst the percentage of houses was only 14.7. On the other hand, there were 43.2 per cent. of cases reported, and 31.2 per cent. of deaths, in the rest of the district, which contained 76.9 per cent. of all the houses. There were also 25.6 per cent. of cases, and 16.8 per cent. of all the deaths, in the space between the half and one-mile radius. The conclusion appears to be inevitable that the small-pox hospital has exerted a most injurious effect, ever since it was opened, upon the public health of the Hackney district.

The important question now arises, Is this injurious influence unavoidable? In other words, is a small-pox hospital injurious *per se?* The answer to this must depend partly on answers to the following queries:—(*a*) Does the disease spread by aerial infection? (*b*) If so, can

the infective matter be destroyed before the air charged with it passes outside? (*c*) If spread chiefly or entirely by infected persons, *i.e.*, by visitors, the sick in ambulances, nurses, and other servants, can this be prevented? (*d*) Does overcrowding the hospital, or the presence of a certain number of patients in one ward or hospital, assist in spreading the disease? and (*e*) Does the presence of a comparatively small number of acute cases by themselves, in a hospital, act as injuriously as a larger number of mixed cases?

As regards the first question, Is there any evidence that small-pox can be disseminated through the air? As there are other papers to be read which will probably discuss this question, partly on the evidence afforded by other writers, I shall bring forward my own experience only, with the exception that I would refer to Mr. Power's Report on the Fulham Hospital in support of this proposition. In a paper which I read before the Society in last April, I stated that I believed the outbreak in Hackney in March last afforded strong evidence in support of this theory, and I shall, therefore, very briefly recapitulate the chief facts of the case. As will be seen by a Table at the end of the Paper, the disease broke out in the Hackney district in December 1883 and January 1884, and diminished in February and early in March to such an extent that, in the week ending the 13th of March, there were only four cases reported, which occurred in different parts of the parish. On the 20th a sudden outbreak occurred, 7 cases being reported for that day, and then 16 for the 21st, 23 for the 22nd and 23rd, 11 for the 24th, and 10 for the 25th, making 67 in less than a week. Most of these cases, as will be seen on the map, were in a comparatively narrow space, extending more than a mile in a south-westerly direction from the hospital. There were no cases in the neighbourhood which could have given rise to the infection of so many persons over so large an extent of ground during the fortnight before the outbreak, and those attacked could not have infected one another, as the whole 67 cases occurred within six days. This outbreak was not confined to Hackney, but extended in a much smaller degree to Bethnal Green, Shoreditch, and Islington; but in these parishes there was not any line of aggregation or grouping of cases as in Hackney. At the time I wrote the paper, I was unable to account in a satisfactory way for the outbreak, as the wind was stated in the summary, published in the Registrar-General's weekly report, to have been generally S.W. I wrote subsequently to the Astronomer Royal at Greenwich, and to Mr. Whipple, the Director at Kew Observatory, for tracings of the direction of the

wind and its force from the 5th to the 11th of March. I then found that between one and five p.m. on the 6th, the wind veered from the S.W. all round the compass, by way of N., E., and S., back to the S.W, and blew for three-quarters of an hour from the N.E., that is to say, over the hospital in the direction of the outbreak. A similar occurrence happened on the 7th, but the veering occupied two hours only, and the wind blew for twenty minutes from the N.E. At the time the wind blew from the N.E. on the 6th, it travelled at the rate of only three miles an hour, and on the 7th, of two miles an hour; that is to say, it was nearly a calm, and therefore far more likely, especially where the eddy caused by the veering is considered, to allow the deposit of any infectious matter held in suspension, or, at any rate, of its being inhaled. On the 10th-11th, the wind, at five p.m. on the 10th, began to back, *i.e.*, go contrary to the apparent motion of the sun, by way of S. and E. to N., occupying sixteen hours in the process, that is to say, until nine a.m. on the 11th. During this time the wind blew for about seven hours from the N.E., the velocity varying between six and eleven miles an hour, generally about eight miles an hour. This is a low rate of velocity, and although not so favourable as on the 6th and 7th, is by no means incompatible with the spread of the disease. It must not, however, be supposed that the direction and velocity of the wind only has to be considered, as a certain amount of moisture in the air, as well as some at present unknown condition of the atmosphere, and unusual potency of the infective matter, seem to be necessary for the spread of small-pox as an epidemic. On the 6th the air was rather moist for March, and decidedly so on the evening of the 7th, whilst on the 10th and 11th it was almost saturated with moisture at the time it blew from N.E. For further details I must refer you to my former paper.

The street in which the disease was most prevalent in 1883-84 was Templar Road, which is situated on the western side of the hospital, having the City of London Infirmary between them. There were no less than 38 cases, although there are only 81 houses in the street; but more than once two or more cases occurred simultaneously in one house, without any ordinary cause for the infection being traceable. Thus, in November 1883, three cases occurred at No. 35 on the same day; two cases in March and two in May, both at the same time. There were cases in this street in January, February, March, and one in April, which was removed on the 14th, and the rooms and clothes disinfected. Single cases occurred on the 5th, 12th, 14th, and 23rd

of May, followed by seven cases in different houses on the 26th and 27th, and one on each day on the 28th, 29th, 30th, and 31st. Now, it is a somewhat singular coincidence—if it be merely a coincidence —that the wind veered round on the 12th, just a fortnight before, from W.S.W. to N.N.E., E. and E.S.E., being precisely the direction (easterly) which would carry the disease from the hospital to Templar Road. Another small outbreak, after a quiescence of more than five weeks, happened on the 27th, 29th, and 30th of September, and on the 1st of November, the wind having blown generally from the E.N.E., and a short time from E. and S.E. on the 12th, 13th, 14th, 15th, and 16th. The residents of Holmbrook Street, which is situated to the south of the hospital, behind The Grove, suffered most during April and the first twelve days of May, the wind being northerly for the greater part of the time from the 24th March to the end of April. Again there was an outbreak in Brooksby's Walk (which is situated on the east of the hospital) on 25th, 26th, 27th, and 28th of May, and the wind was generally westerly on the 11th, 12th, 13th, 14th, and 15th of the month.

The next case I will mention is that of Clifden Road, which is on the north of the hospital, where an outbreak took place on the 22nd, 23rd, 25th, 26th, and 28th of May. The wind was variable, but more or less southerly from the 6th to the 17th of May. I have thus shown that the inhabitants of the streets immediately adjacent to, and those situated to the north, south, east, and west of the hospital, suffered most from the disease, when the wind blew towards them from the hospital about a fortnight before. The intervention of the infirmary between the hospital and Templar Road, and the Fever Hospital and Clifden Road, do not seem to have had any effect in preventing the spread of the disease in these streets. It also agrees with this view, that The Grove intervenes between the hospital and Holmbrook Street, and yet the inhabitants of The Grove did not suffer much in 1883-84, and those of Holmbrook Street did. The disease was, however, very severe in The Grove in former epidemics; but the same may be said of Holmbrook Street, Brooksby's Walk, Clifden Road, and Templar Road.

A very striking outbreak took place on October 30th, and on Nov. 1st and 3rd, 1876, in Templar Road, Churchill Road, College Street, and Homerton College, amounting in all to 11 cases, and without any known causes of infection. The persons attacked did not know one another, or have anything in common. The wind during the first fortnight of October was more or less southerly, veering from the

west to the east, but on the 14th and 15th it was easterly, and remained E. or N.E. for some days. From the 13th to the 19th inclusive, its velocity was much below the average, and it contained an unusual amount of moisture, especially on the 14th and 15th, so that all the conditions favourable for the spread of the disease from the hospital to the streets were present at the time that the infection took place. There had not been any cases in these streets for months, so that I think I am justified in assuming that the infection was carried by the air to the affected persons.

In order to prevent aerial infection of the neighbourhood surrounding a small-pox hospital, it has been proposed, I think by Dr. Sanderson, to have the hospitals built of a circular form, with arrangements for drawing all the air through a furnace, and destroying all the organic matter.

There is no doubt that infection by what is called personal contact, that is to say, by infected persons or things coming or being brought near to the healthy, is the ordinary manner in which the disease is spread. An examination of the order in which cases occur, at any rate in the early part of an epidemic, shows that there is an outbreak' at first nearly 14 days after the first. For instance, at Hackney Wick, a severe outbreak took place on October 30th (one case having occurred on the 17th), and others subsequently on the 14th and 15th of November, and I have noticed this in every epidemic at different places. I mention Hackney Wick because it is isolated from the remainder of the district and surrounded by open country. Every precaution should therefore be taken to prevent a hospital being a source of infection to a neighbourhood, both as regards the structure and the general and ambulance arrangements. At Homerton, as the tradespeople and others have to enter the hospital grounds to deliver goods, and as there is only one common entrance for patients and visitors to the Small-pox and Fever Hospitals, I cannot say that the best practicable means have hitherto been carried out, although they will, I hope, soon be, by the completion of the works now nearly finished.

One question of great moment is the number of patients who may be treated at one time in a small-pox hospital without much risk to the inhabitants of the surrounding neighbourhood. During the early period after the establishment of the hospital, the disease did not become epidemic in its vicinity until nearly 80 patients were in the hospital; but I stated in 1882, before the Royal Commission, that I did not think more than 60 patients should be placed on the site at

Homerton. I then referred to mixed cases, and especially mentioned small wards, as I believe that the present wards are too large, and allow the congregation of too many patients in one room. I cannot now say that 60 or even 30 patients suffering in the acute stage can be safely treated at Homerton; but as a very large number of patients have been moved into and out of the hospital—as many as 224 having been brought in and taken away in one week in May, very few of whom were counted as patients because they did not sleep there—I cannot say how far this incessant carrying about of small-pox patients in the district assisted in infecting the neighbourhood, but I believe it was decidedly injurious. As a contrast, I may mention that in 1871 there was a small-pox hospital at Clapton, in which there were not, to the best of my knowledge, so many as 30 patients at any one time, and the moving of patients too and fro was comparatively rare. The disease spread to two houses only, and those were next the hospital recreation ground. The back gardens of a row of houses behind the hospital were within 30 feet of the hospital, but the disease did not spread to any of the inmates. There is, however, a difficulty arising from the more or less perfect vaccination of those exposed to small-pox infection, and therefore I cannot say if the disease would have spread if the inhabitants of these houses had been susceptible to the disease. There was not any house near the front or sides of the hospital, except the two just mentioned.

Before concluding, I desire to express my opinion that the number of patients who may be safely treated in a hospital during non-epidemic periods should not be received and kept there during an epidemic. I am also of opinion that all the evidence I have read shows that every one of the metropolitan small-pox hospitals has proved injurious to the public health of the neighbourhood in which it is placed; but I believe that it is possible to treat patients in small numbers in hospitals in London without injurious results. The wards, in my opinion, should be small; the traffic of ambulances, visitors, tradespeople, and others as restricted as possible; the open space surrounding the wards and recreation ground as large as can be obtained; and means taken to prevent small solid particles being blown from the wards into the open air. If wire-gauze were spread over the window openings, as was done by my direction at the Clapton Hospital in 1871, and to which I attribute much of the immunity from disease in the neighbourhood, I believe the metropolitan hospitals would cease to be so injurious as they now are. Although I express this adverse opinion

to the present hospitals as arranged and conducted, I do not consider that they should be closed; on the contrary, I believe that they can be carried on in such a way as to confer much benefit, and cause little injury to the neighbourhood in which the hospital is placed.

I cannot conclude without making a remark concerning my opinion as to the spread of small-pox from the hospital by aerial infection. Dr. Wilson says in his paper—"that in 1881 I did not consider it necessary to invoke extraordinary channels of infection to account for the spread of small-pox noted in the vicinity of the hospital." I am not aware of any particular statement of mine in that year, but he seems to have overlooked the following paragraph in my evidence before the Royal Commissioners in January 1882, which is printed at p. 156, and shows that if I did not express my opinion on the matter it was an oversight, and that I held the same opinion then as I do now.

"I wish, however, to state that I cannot explain the frequent occurrence of small-pox in two of the streets adjoining the Homerton Hospital by the ordinary means of infection—I allude to Templar Road and Clifden Road. The nearest houses in the former street are situated more than 400 feet from the nearest point of the small-pox hospital, and the inhabitants have suffered severely whenever the fever hospital was used for small-pox cases, *i.e.*, when from 150 to about 350 patients were congregated on that site. The inhabitants of Clifden Road, as I have already stated, also suffered at this time in a similar way. Ambulances do not pass down these streets, which are not in the line of traffic even for visitors to the patients, so that I cannot explain these outbreaks except on the supposition of infection being carried by the air. The difficulty as regards Templar Road is, that the City of London Union Workhouse intervenes between the hospital and Templar Road, so that if the infection has been carried by the air, it must have been blown over the workhouse. In Churchill Road, which lies parallel with Templar Road, and is occupied by the same class of people, but which is about 180 feet further from the hospital, the disease has not prevailed to a like extent."

Table showing the number of Small-pox Patients removed by the Asylums Board to their Hospitals from the several Metropolitan Parishes on the North side of the Thames; also the total number of cases reported at the Town Hall, Hackney, and the number transferred to Ships from the Metropolis, from October 1st, 1883, to September 30th, 1884.

Total Cases reported at Hackney Town Hall.	Months.	Total Cases Removed to Hospitals and Ships.	Total Cases, Hackney, Removed.	Patients Transferred to Ships.	Hackney. Percentages to Total Cases in each month.
	1883.				
2	October .	21	2	...	9.5
20	November .	38	14	...	37.0
38	December .	64	33	...	51.6
	1884.				
43	January .	68	33	...	48.5
27	February .	66	21	...	31.8
103	March .	201	89	147	44.2
138	April . .	253	99	219	39.1
348	May . .	859	285	763	33.1
272	June . .	865	193	331	22.3
112	July . .	402	67	84	16.6
40	August . .	192	23	39	12.0
68	September .	311	64	32	20.5
1211		3340	923	1615	
	1884.				
	October .	374	74	44	19.8
	November .	621	33	117	5.3
	December .	525	43	98	8.2
		1520	150	259	

NOTE.—Of the 859 cases removed from the Metropolitan Parishes on the north side of the Thames during May 1884, 285 belonged to Hackney, 143 to Bethnal Green, 86 to Shoreditch, and 56 to Islington, making a total of 570 from Hackney District and adjoining Parishes.

Discussion.

The President, in moving a vote of thanks to the readers of the papers, said he had long desired to have the subject dealt with by the Society, but it had been thought desirable to defer any discussion of it until after the trial of the Darenth action. Dr. Wilson had demonstrated his fitness to introduce the subject by his able analysis of Mr. Power's report, published in the *Lancet* last year. He had regarded the subject from an impartial point of view, but possibly with a preconception, which had been shared by the profession as a whole, that small-pox contagion could not be disseminated aerially to a great distance, as suggested by Mr. Power. He (the President) had felt that the interest of the discussion would be enhanced by hearing what was to be said on the other side in support of Mr. Power's views, and he believed the Society would endorse the propriety of his selection of Drs. Tripe and Gwynn, who in their interesting contributions had partially given an affirmative answer to the question propounded in the title of Dr. Wilson's valuable paper. He appealed to local Medical Officers of Health for information respecting small-pox prevalence in the vicinity of the other hospitals—Deptford, Plaistow, Stockwell, and Fulham—and suggested the advisability of limiting any statement of facts to the epidemic of 1884, the particulars of previous epidemics having already been pretty well exhausted.

Dr. Gibbon said he thought that the theory of this disease spreading by aerial infection, after listening to the papers, was a fallacy, and that it was the old and proved method by which the disease has been carried—by traffic; and cases within these quarter-mile radiuses were just as likely to result from infected traffic going to and fro, as from particles of contagion escaping from the hospital and sailing through the air. Besides, it was not yet decided that the virus consisted of particles. That was a mere assumption. It was more probable that the infection arose in other ways than by hypothetical aerial particles. Since these large isolating hospitals had been constructed, the mortality had, on the average, been three times as great as in the seven previous epidemics. Take the epidemics since vaccination had been gratuitous and compulsory. In the 1844 and 1845 epidemic, the disease killed in London 2713; in 1848 the number was 2721; in 1851 it was 2222; and in 1855,

1024; in 1859-60 it was 2033; in 1863, 2012; and in 1866, 2720. Since this method of wholesale isolation, this taking of persons from an infected district of London, and dragging them through the streets of unaffected and healthy parishes, to Hampstead and other hospitals, and by such procedure stirring up and mixing the leaven of the disease among the whole population, the deaths rose in 1871-2 to 9657, and in 1876-7-8 they were 4570. Taking the average of the deaths during the first seven epidemics, when small-pox was left to isolate itself—and it was a self-isolating disease—the average mortality was 2185·2, whereas, during the last two epidemics it was 7113·5, or three times as great. In the former epidemics there was one death in about every 1500, in the latter one in every 500 living persons. If one sought for any explanation of this anomaly, he thought no satisfactory explanation could be given, except the mode in which the disease was treated by the Metropolitan Asylums Board. The patients and the poison were the same, or, in consequence of vaccination, the patients were less susceptible, and yet the results in the last two epidemics were so disastrously different; and he thought it was the system of wholesale isolation, and the passing of the disease through uncontaminated portions of the metropolis, that caused it to invade all the metropolitan districts and parishes. Of course, in saying this, he held that the same explanation accounts for the spread and concentration of the disease in the immediate neighbourhoods of the hospitals, which are obviously more exposed to infection by the in-coming and out-going traffic than remoter areas. He made an exception in the case of Fulham Hospital, because nearly all nurses and visitors were taken by railway; but that would not diminish the spread of the disease in the metropolis as a whole. A nurse from that hospital once told him that they (the nurses) made no hesitation in getting into a train or carriage with other people, even though they had only just left the hospital. Before accepting Dr. Tripe's theory, the very existence of these flying particles ought to be demonstrated. It must be remembered, of course, that the virus of small-pox could be kept active for twelve or more years. Some practitioners used to keep the scabs of cow-pox; and in the same way lymph between glasses has been kept potent by himself for fifteen years. If Dr. Tripe could prove that these flying particles of virus were of any bulk or size, he might, perhaps, agree with him as to distinct aerial contagion.

Dr. ILIFF (Newington) suggested that there should be an adjournment of the discussion, as it was impossible to finish it that night,

and he did not think they were yet quite able to come to a decision on the question as to how infection was carried, or as to the danger caused by the small-pox hospitals. In the case of Croydon referred to in the letter read that evening, they had the fact that a workhouse and other buildings had escaped altogether, although in close propinquity to small-pox cases. There was no small-pox hospital in Newington, but there had been two severe outbreaks, and if they had occurred near a hospital they would no doubt have been attributed to them. One great fact was clearly demonstrated, viz., the number of unvaccinated persons, and the fatality amongst them. The first five cases occurred in one house, roomy and airy ; three had never been vaccinated, and all died. The first case (one year old) was wished by the officers to be removed, but the parents positively refused. It died in 36 hours after being seen by him ; had it been removed, no doubt he would have been charged with causing its death. One case only on the opposite side of the street was traceable to the first house. On the 20th of December, in the evening, the Inspector was called to a house, in one room of which one youth was dead, and another in the throes of death. The room door was wide open, and all around it were crowding children and adults, courting disease. The bodies were removed to the mortuary, everything burnt, and disinfectants freely supplied. From these cases small-pox spread through the house (overcrowded and dirty it was true), and nine fresh cases, all unvaccinated, occurred in four families, with six deaths. From this house the disease spread to a house at the end of the yard of the first house, and four cases occurred there. Ultimately, within a quarter of a mile radius, at least 50 cases came to his knowledge. These facts might seem to favour the view of aerial dissemination, but the cases were all near each other, and gross carelessness was exhibited in the crowding near the doors, of men, women, and children, watching what ? only the removal of sick cases in the ambulance, and of bedding, etc., for destruction or disinfection. The whole of this outbreak was clearly due to the most culpable retention and concealment of the two first cases. An inquest was held through the instrumentality of the officers, the verdict being moral neglect. He agreed with Dr. Tripe in many things, and that large wards were an objection ; small wards were more under control, and would localise the disease better. He considered that hospitals should not be built near houses or high roads ; he thought it most essential that they should stand in their own grounds, surrounded by a good belt of trees. A great prejudice was found to exist against

vaccination and re-vaccination, fomented by Miss Jessie Craigen, who personally visited the house last referred to with the object of thwarting the efforts made to check the spread of the disease by vaccination. He was happy to state that prompt removal was now generally carried out.

Dr. ROBERT PRINGLE said, during his service of thirty years with the Bengal Army, he had devoted special attention to the subjects of small-pox, inoculation, and vaccination, and for the last twenty years had been endeavouring to win over to vaccination the inhabitants of the independent native state of Sirri Ghurwâl in the Himalayahs, which might be said to be the home, from time immemorial, of inoculation. For this purpose, as far as was practicable, he had, for similarity in the performance of the operation as a commencement, employed the dried vaccine lymph in the form of crusts, and then found out what an important part the small-pox crusts must play in the dissemination of the disease. If a small-pox crust was examined, it would be found to be specially constructed for the purpose of disseminating the disease, as the small quantity of dried variolous virus, when aided by the light tissue-like substance surrounding it, was very apt to be blown about; and this dried virus, when reduced to powder, only needed moisture to enable it to germinate at once, when it found a suitable locality. Thus a few small-pox crusts, mixed with the sugar gathered up from the floor of a sugar factory in the plains of Hindostan, were the means of originating an outbreak of small-pox in one of the vaccine lymph-nurseries, where children were kept for the purpose of collecting vaccine lymph for the operations in the plains, when the matter was suitable. Before leaving India he had the satisfaction of seeing vaccination entirely take the place of inoculation, with the consent of the Rajah and his people, and many hereditary inoculators were now practising vaccination. In this country it was difficult to convey any idea of the prevalence of small-pox in India. In his circle, for instance, in 1864, when he introduced the present scheme, with a population of ten millions in a country larger than England and Scotland, 95 per cent. of the adult population were marked with small-pox. Had the children's school he inspected a few days ago in Greenwich been in India, 90 per cent. of them would have been marked with small-pox, whereas in Greenwich only one child out of nearly 150 was marked. In his opinion, the most infectious stage of small-pox was the scabbing stage; and the vesicular stage was innocuous till after the fourth complete day.

January 26th, 1885.—*Discussion continued.*

Dr. ROBERTS, in continuing the discussion, said the hospital at Deptford, up to the last four or five years, was surrounded by market gardens, which were now all built upon, and they found that small-pox was always present near the hospital. In the year 1884 there were 41 cases reported within a quarter of a mile of the hospital: it was just on the border of his district, so he could only speak as to one side of it, the other side being in Camberwell parish. He might state that, in addition to the 41 cases, they had 27 within the mile, and 78 over the mile. Most of the houses were recently built, and many of the attendants at the hospital lived in the neighbourhood, which might have something to do with the spread of the disease. Before the houses were built, he learned, on speaking to the proprietor of a market garden, a very curious fact—that every man he put on to plough the land had small-pox; perhaps, because they used to plough right up to the hospital wall.

Mr. CORNER said that from May 1881 to May 1882, the Plaistow Hospital was made use of by the Poplar Board, but never contained more than twenty cases at the same time. There was no evidence of the disease spreading to the outside during that period. He had a statement from the Poor-law Medical Officer, that since the Metropolitan Asylums Board had had possession of the hospital from May 1884, he was perfectly convinced that it had been the centre for the spread of infection. He need not give the gentleman's name, but he was perfectly sure that there was a greater number of cases within the quarter-mile radius than outside that distance. The experience of the Poplar district was the same when the hospital ships were moored off Greenwich, no cases having occurred traceable to them.

The PRESIDENT said he had invited Medical Officers of Health acting in districts which had small-pox hospitals in or near them, to favour the Society with their experience of small-pox prevalence in 1884. He could speak with regard to the Fulham Hospital only, this being situated a little to the west of Kensington. The "Special Area", they would remember, was a circle of a mile radius, with the hospital for its centre, and it had been sub-divided by Mr. Power into a quarter-mile inner circle, and three outer rings of a quarter-mile width. The whole of the special area was in the borough of Chelsea, comprising the parishes of Kensington, Fulham, and Chelsea, but Chelsea lay outside the inner quarter-mile circle. The number

of the houses in this inner circle in 1881 was 432, and the number in the three rings from within outwards was 3,488, 4,224, and 3,569 respectively; total in special area, 11,713. He could not ascertain the relative number of houses in the several parishes. The population of the special area might, perhaps, be taken at 85,000 to 90,000. For convenience, the parish of Kensington might be divided into north and south, the line of demarcation being drawn along Uxbridge Road. The population of each division might be taken at 85,000. In 1884 there had been 177 cases of small-pox recorded in the entire parish, 76 in the north and 101 in the south. The Kensington part of the special area was wholly within the south division, and in it there had been 60 cases, 117 cases having occurred outside the special area; of the 60 cases 10 were within the quarter-mile inner circle, and 20, 10, and 20 in the three quarter-mile rings from within outwards. He did not know the population of the Kensington part of the special area, and so could not state percentages of cases to population, but, no doubt, the cases had been relatively more numerous in the special area than in the remainder of South Kensington. Especially would this be true in regard to the inner circle, if "percentages of houses newly invaded" were taken, after Mr. Power's method. The 60 cases occurred in 46 houses in 40 streets. In 35 streets one house only was invaded; in two streets, two houses; in two streets, three houses; and in one street, four houses. In the remaining streets, about 130, there had been, so far as he knew, no small-pox. Three cases occurred in Ifield Road, of famous memory, at intervals of two and four months. Six cases (four in one house) occurred in three streets in St. Mark's district, Fulham Road, a *cul de sac*, the three houses being invaded in June, October, and December respectively. In one street only did two houses become invaded simultaneously. The year 1884 might conveniently be divided into two periods (1), January 1 to May 31; and (2), June 1 to December 31. Fulham Hospital was opened May 17, so that any influence it might have had on the special area could not have come into operation until the end of May. Prior to June 1, there had been 23 cases of small-pox in Kensington, of which two were within the special area. In the remainder of the year, the hospital being open, there were 154 cases, of which 58 were within the special area. He submitted the following tabular statement of cases, premising that of the 23 cases in the first period, twelve in the north district, and four in the south district, occurred in May, just before the hospital was opened.

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Period.	North Kensington.	South Kensington.	Total cases.
January 1st to May 31st	13	10	23
June 1st to 14th (2 weeks)	15	26	41
June 15th to July 12th (4 weeks)	18	17	35
July 13th to August 9th (4 weeks)	3	2	5
August 10th to September 6th (4 weeks)	2	—	2
September 7th to October 4th (4 weeks)	4	3	7
October 5th to November 1st (4 weeks)	5	2	7
November 2nd to 29th (4 weeks)	11	9	20
November 30th to January 3rd (5 weeks)	5	32	37
	76	101	177

The disease, it thus appeared, was prevalent in the parish before the hospital was opened (May 17), but it increased considerably, for a short time, immediately after the hospital was opened, for in two weeks, June 1-14, 26 cases occurred in South Kensington. Of these 26 cases, 18 were infected on May 19, 20, and 21, and four on the two following days. Thus there were 22 cases infected in five days; four in the central circle; five, three, and three in the three outer rings ; and seven outside the special area. During the three days, May 19-21, four cases were admitted into hospital from Fulham and two from Chelsea, but one of the Chelsea cases came from a detached part of the parish, situated north of Kensington. On these three days, May 19-21, the meteorological conditions resembled those described by Mr. Power as having characterised the weather of January 13-17, 1881, when the cases were infected which constituted his "notable outburst" in the special area, January 26-30, viz., calm, wind easterly for the first half period, westerly and variable afterwards, but no "pressure" to record, and horizontal movement much below average ; no ozone; some mist and fog, especially on the first two days. Seven Kensington cases were infected on May 19, the same number on May 20, and four on May 21. On these days there were three patients in Fulham Hospital (two of them admitted May 19). The hospital occupied a site of six acres. Neither of the three cases had been admitted from the special area, and of the 18 cases infected May 19-21, the nearest resided at a distance of nearly a quarter of a mile from the hospital. He had been thus particular in referring to the above "outburst", because it was, as regarded Kensington, even more "notable" than that of January 1881 ; because it was practically confined to Kensington, which was invaded by small-pox before Fulham and Chelsea, and because there was nothing like it afterwards in 1884. In the following 39 days, completing a period

of six weeks (from June 1 to July 12), there were only 25 cases in South Kensington. At the end of 1884, in a period of eight weeks, 41 cases were recorded in South Kensington, 3, 3, 3, 8, 7, 7, 4, and 6, in the several weeks. The maximum number of cases in the hospital during this period, at the end of any week, was 18; maximum weekly admissions, 18 ; maximum weekly discharges to other hospitals, 13; so, it might be said, that there was no excessive amount of small-pox among the 85,000 people of South Kensington, no excessive number in hospital, no excessive admissions or discharges, and therefore no large amount of small-pox traffic. Between July 13 and November 1 the quantity of small-pox in South Kensington, as the table shewed, was insignificant (seven cases in 16 weeks), the hospital being at work the whole time. Its operations in 1884 were mainly restricted to Borough of Chelsea cases ; for of 300 cases admitted, only 90 came from other parishes, Kensington contributing 93, Fulham 81, and Chelsea 36. The re-opening of the hospital, in fact, was necessitated by the extension of small-pox from the East End to the parishes constituting the borough, and notably, first of all, to Kensington. The admissions never exceeded 46 in a fortnight, and they fell off considerably when, after June 20, the practice of sending "mild" cases to the hospital ships first began. As usual, a large proportion of the South Kensington cases were domestic servants, 37 out of 101 ; 32 were female servants from 30 houses. Two servants were sent from each of three houses, the primary case having been overlooked or regarded as chicken-pox. The "upper classes" escaped almost completely. It only remained to say that, of the 101 sick, 5 were imported cases, and 30 were secondary cases ; that three persons "walked in" to hospital, that two were removed from out-patient rooms of public institutions, and that 15 were treated at home, irrespective of concealed cases. At no period during 1884 were there more than 30 cases in the hospital at the same time.

Dr. J. H. Bridges said, that though he had not the same facilities as most of those present of studying small-pox in its relation to any special part of London, he had had opportunities of observing, though in a cursory and imperfect way, its diffusion through the metropolis during the last fifteen years. There was a general agreement that small-pox hospitals were somewhat dangerous ; the experience of the last two years had been such as to increase the sense of danger. The table compiled by the Managers of the Metropolitan Asylums Board, and published on page 343 of the Report of the Royal

Commission, shewed that, of the four areas round each small-pox hospital, viz., the quarter-mile radius, and the three concentric rings, each of a quarter-mile breadth, areas standing to one another in the proportion of 1, 3, 5, and 7, the first was invariably affected disproportionately to the rest, *e.g.*, in the case of Stockwell in 1871-2, the innermost area, which might be called the bull's-eye, had 75 cases; the ring surrounding it, which had three times the area, showed not 3 × 75 cases, but only 122, and so on. And this appeared, from the table, to hold good of every hospital in each of the epidemics. But, during the last year, very fundamental changes had been introduced in the mode of dealing with small-pox cases. The hospitals in London now contained a maximum of 25 cases, instead of between 200 and 300 as heretofore; the large mass of cases being removed to the ships at Long Reach or to the camp at Darenth. The question was, how far had this change affected the distribution of small-pox in the neighbourhood of the hospitals? The new system became complete on June 17th, 1884, when, for the first time, patients able to bear the journey were removed directly from their homes to the water-side. Taking the facts of the last six months of 1884, it would appear that the rates per 100,000 of population in which the 30 registration districts were affected with small-pox, were in the following order: St. George's-in-the-East, Hampstead, Poplar, Bethnal Green, Mile End, Hackney, Shoreditch, Bloomsbury, St. Pancras, Whitechapel, Greenwich, Strand, Islington, Stepney, Holborn, St. Saviour's, Westminster, Camberwell, Marylebone, Kensington, City of London, St. Olave's, Lambeth, Paddington, Woolwich, Chelsea, St. George's, Hanover Square, Wandsworth, Lewisham, Fulham; the rates varying from 253 per 100,000 in St. George's-in-the-East, to 20 in Fulham. It would be noted that Hampstead and Hackney stood high in the list; on the other hand, Lambeth, Chelsea, and Fulham stood low. Coming to details, it would seem that certain streets in the immediate neighbourhood of Stockwell, as Landor Street, which had been affected in all previous epidemics, had been on this occasion unaffected. Again, the new streets built close to Deptford Hospital had not suffered in any undue proportion. Hampstead had suffered more severely than when the hospital held ten times the number; this would point to contagion from some other source than the hospital, especially as there was small-pox in the immediate neighbourhood of the hospital before it was opened in the spring. The medical profession were unanimous in believing in the diffusion of small-pox, but men still remained divided into the two classes of

"short diffusionists" and "long diffusionists". Mr. Power's report had done the invaluable service of bringing the long diffusion theory before them in a very definite and precise way. The strength of his case rested on the 32 cases that occurred round Fulham Hospital between January 26th and 30th, 1881, of which only nine could be accounted for. It might be doubted, however, whether the inability to trace the origin of cases at the commencement of an epidemic was a fact on which very strong conclusions could be based. Few but those specially conversant with the management of epidemics, had an adequate idea of the proportion of cases in which, owing to the slightness of the attack, there was a real difficulty, even to an experienced eye, in distinguishing variola from varicella and some other diseases. It was, perhaps, not an illegitimate hypothesis, in view of what was becoming known as to the varying virulence of micro-organisms under different conditions, to suppose that, in the intervals between small-pox epidemics, the filiation of the disease was maintained by series of slight imperceptible cases. This would, perhaps, better account for the difficulty of tracing the origin of cases at the commencement of an epidemic, than the hypothesis of long diffusion advanced by Mr. Power, an hypothesis against which was to be set the remarkable facts adduced by Dr. Collie and by himself, as to the immunity of inhabitants of institutions adjoining small-pox hospitals, unprotected by re-vaccination, but protected from immediate contact with the disease. But on this important question there still remained room for further investigation; such investigation should, as far as possible, be collective, and would, he hoped, be carried on by the members of this Society.

Dr. WILLIAM SQUIRE said that varioloid was often mistaken for chicken-pox, and for some popular skin diseases, and thus carried on the contagion of small-pox. He took this opportunity of saying how completely he agreed with the substance of Dr. Wilson's paper, and especially with the concluding part of it. He wished entirely to contravert Dr. Gwynn's conclusion, and believed that no efforts to control small-pox would be successful without means of isolating it in hospital. Dr. Gwynn had spoken of the course of the sewers and of the smells from brickfields; but they had nothing to show that small-pox came from sewers. It was not the same poison as typhoid, and it was not soluble. In face of good negative evidence he thought it was a great assumption to suppose that infecting particles of small-pox could be disseminated in that way, or in the same way as the smell from burning bricks. The poison was not a chemical gas, nor

capable of being vaporised. Dr. Tripe asserted that the infecting matter could be carried twenty or thirty yards, and that it could not be oxidised in air. There was, however, no proof that the infection of small-pox ever was air-wafted across any London street, and the broadest seldom exceed twenty yards in breadth. Air might not destroy some of the particles given off by the sick, but it destroyed their infecting powers. The micrococci in the lymph might be cultivated and multiplied out of the body, but they had lost their power to reproduce small-pox. They had simply lost that infective power which they had when they left the body. As an illustration of how readily aerial infection was invoked without cause, he referred to an outbreak at Ampthill, in the summer of 1882. A tramp came to the workhouse with small-pox: the linen and rags were burnt. In twelve or fourteen days there was another case in Oliver Street, and there was a cry that cremation of the clothes was wrong, and had carried the infection to this street, the nearest one to the workhouse, and there was quite a panic. There was another case at the same time in the next village, and then there was a cry of aerial distribution; but it turned out that the first man actually rested in these houses on his way to the workhouse. It was curious to see how circles were drawn round the hospitals in the papers. He could draw circles round other centres quite as instructive. There was thus a group of cases in Bethnal Green at the same time as the Hackney groups. This certainly did not come from the hospital. A stonemason was first infected, but instead of his being employed at the hospital, he was employed by Messrs. Mowlem and Co., and his work was confined to the City of London for weeks before the 29th March, when he was taken ill. Twenty other cases originated from this one, and without the aid of the hospital at Homerton this outbreak would have persisted longer. Dr. Tripe has given an instance where thirty feet between a small-pox hospital and a row of houses behind, sufficed to prevent the disease extending from the hospital to the houses. It was to be regretted that Dr. Tripe, who had done so much to prevent the spread of disease, should have been the cause of a restriction in numbers treated in the hospitals that had seriously interfered with the means of dealing with the present epidemic. This error on his part made him quote from Shakespeare:

> "The painful warrior famoused for fight,
> After a thousand victories once foiled,
> Is from the book of honour razed quite,
> And all the rest forgot for which he toiled."

Dr. Tripe advocated before the Royal Commission this restriction of numbers to some 36, and then had to regret, as a consequence of his suggestion being adopted, that 224 cases in May last were taken in and out of the hospital because of this restriction, not without risk of injury to the neighbourhood. There was evidence that the aggregation of a large number of small-pox patients in one place was not injurious to the progress of the individual cases—witness the results at Bicêtre during the siege of Paris, as given by M. Lèon Colin, in his work *La Variole*. There was no evidence that large wards were any worse for the treatment of small-pox cases than small ones; there was no evidence that the aggregation of large numbers of small-pox cases was any worse for the neighbourhood than the aggregate of small numbers. The experience of Fulham Hospital was all the other way. In 1881, just before the unfortunate litigation commenced, and before the Royal Commission sat, 1752 cases of small-pox were treated there; all the wards were full during April, May, and June, accommodating 300 cases. Yet when the admissions were over 300 a month, the percentage of mortality was only 14.1, and of the severest cases unmodified by vaccination, 44.2. In the large, well ventilated wards, 683 visitors paid 1,391 visits, and only nine of these caught small-pox while visiting the sick. This shewed ventilation to be of use in diminishing the risks of infection. The prevalence of small-pox in the district around was not so great as it had been before and since. To say that large hospitals were injurious to the public or patients was either a guess or a groundless assertion. He did not think aggregation of cases dangerous to the public, and he did not think it was worse for the patients. In the case of the Fulham Hospital, the mortality was less when it was full than at any other time, and it was not worse for the people outside, for there were a smaller number of cases then. The present restriction as to the number of small-pox patients to be treated in one hospital at one time in London was in every way objectionable. It was injurious to the outside public, and it was not warranted by anything they knew scientifically. Special hospitals for small-pox cases were effective in stopping the spread of small-pox in any town in England, and might become as effective in London.

Mr. MURPHY stated that in St. Pancras small-pox was very prevalent, especially at Highgate, in Retcar Street, Raydon Street, etc. The disease made its first appearance in the upper part of the parish, where the Hampstead and Highgate Hospitals were located; and then, some months later, it appeared in the southern part of the

parish. In the four weeks of November it was in the Kentish Town sub-registration district, which was exposed to the influence of the hospitals in the north; but it had now invaded the houses in the Gray's Inn registration district. During the last few weeks there had been a development of the disease, so that cases now were equally numerous in the south. He suspected that small-pox had been travelling from some other quarter—perhaps from Homerton across Islington. It could not cross the Cattle Market, but in the Caledonian Road there was a continuous line of houses.

Dr. BRIDGES asked whether any information would be given that night as to the mode of conveyance, and as to the ambulances of the Highgate Hospital?

The PRESIDENT stated that the authorities of the Highgate Hospital had no ambulances of their own, and that the Metropolitan Asylums Board would not lend theirs to anybody. The friends of patients going to Highgate hired private ambulances.

Mr. BUTTERFIELD, although a provincial Medical Officer of Health, had taken a great interest in the dissemination of small-pox in the metropolis, because, in his experience, a large proportion of the cases met with in the country were traceable to London. He was of opinion that small-pox hospitals were a source of danger to the localities surrounding them, but had not been led to believe that aerial dissemination was the cause of the excessive prevalence in their vicinity. He knew of only two cases in which small-pox had spread from the Bradford Fever Hospital. In one it was proved that the boy infected had been beckoned by a convalescent patient to the walls of the hospital, and had received some coins from him, with which he purchased tobacco, and conveyed it to the patient. The boy was himself a patient a fortnight after the transaction. In the second instance, the daughter of a scrubber temporarily employed in the small pox wards was infected. The hospital of Bradford was not used exclusively for small-pox. It was built in pavilions, connected together by corridors. During the ten years of his experience in Bradford he only knew of one instance of small-pox spreading in the hospital, and in that case it was proved that a nurse from the small-pox ward had gone to another ward, to obtain a dose of castor oil. As to the way in which small-pox was disseminated, Medical Officers of Health in the provinces, owing to the greater intimacy which existed between neighbours in provincial towns, were better able to trace cases to their source than their metropolitan brethren, who had to deal with masses of people, personally, for the most part, unknown to each other. Provincial Medical Officers of Health had not much experience of small-

pox in the wholesale manner in which it existed in London, but had frequent opportunities of dealing with outbreaks, which, if left to themselves, would be the commencement of epidemics. He rarely found much difficulty in tracing the origin of cases. The constant character of the period of incubation in small-pox was a great help. If the whereabouts of the patient fourteen days before the appearance of the rash could be ascertained, a clue to the source of infection was generally found. He corroborated a remark of Dr. Bridges as to the carrying-on of infection by persons having the disease in a mild and unsuspected form, and related the case of a lady who came to Bradford with an unvaccinated child. A few days after her arrival, the child had confluent small-pox, of which it died in the hospital. It was subsequently elicited from the mother that small-pox was prevalent in Camberwell, where she resided, and that she herself, a week or two before leaving London, had suffered from back-ache and sickness, succeeded by the appearance of a few pustules. Without being aware of it, she had evidently had modified small-pox, and probably had helped to spread the disease in Camberwell. Considering the many ways in which the infection of small-pox could be transmitted, he was not surprised at its undue prevalence in the neighbourhood of small-pox hospitals. Persons who had accompanied patients in the ambulance were not unlikely to seek refreshment in the nearest public houses, coffee shops, or even dairies, and thus come in contact with the residents. He did not think it necessary to set up the hypothesis of aeriel dissemination, and would conclude by expressing his belief that the infection of small-pox neither went up the chimneys, nor out of the windows, nor over the walls, but came out at the gates.

Dr. WILSON, in reply (being unable to remain for the close of the discussion), said it was very gratifying to him to find that his paper had been the means of bringing about such an important and interesting discussion. Personally, he had been at a disadvantage in having little practical acquaintance with small-pox. Cheltenham was, perhaps, the worst town in England for studying the disease, as, during the last eleven years, isolation had been so completely carried out, by means of the Delancey Hospital, that, although imported cases occurred year by year, small-pox had in no instance spread beyond the house into which it had been introduced. In the course of the present discussion, he thought that some of the speakers had diverged from the real point at issue. The special incidence of small-pox round small-pox hospitals in London was granted on all hands, and this inquiry might be limited to *the cause* of such in-

cidence. Was it due to ordinary human intercouse, exaggerated as this must be, round hospitals in crowded localities? or had they to deal with aerial dissemination of infection to long distances through the air? If due to the first, the evils might be met by increased precautions and care; by curtailing the leave of nurses, by controlling the ambulance arrangements, by more complete isolation of the hospitals themselves. If due to the second, the mischief, though more difficult to deal with, was not irremediable. His position was that "distal aerial dissemination", or "long diffusion", say to 150 feet, was "non proven". Mr. Power's deductions from his premises were fairly drawn, but if, as was contended, the premises were wrong, the conclusions fell to the ground. Two papers had been read by Dr. Tripe and Dr. Gwynn, upholding the same theory of "distal diffusion", and it was interesting to observe the points on which they differed from Mr. Power and from each other. Mr. Power held that when acute cases were accumulating in a hospital at the commencement of an epidemic, the infection accumulated also, until, under some special condition of atmosphere, it was disseminated to a distance of a mile or a mile and a half. Dr. Tripe and Dr. Gwynn thought that it flew in the direction of the wind, and that the diffusion did not in any way depend upon the numbers at the time in hospital. There were, however, curious cases of exemption, for at Hampstead, houses at a distance were first attacked, and the disease converged upon the hospital; and at Homerton, the City of London Workhouse was passed over in a very remarkable manner, difficult to reconcile with any theory of "distal diffusion". There seemed to be no consensus of opinion on many important points, and as Dr. Bridges had observed, they had much to learn. They did not know how far healthy persons could carry infection; nor was it certain that the usual fourteen days of incubation was always adhered to. Much confusion also had arisen from speaking indifferently of free particulate matter, of micrococci, and of scabs. These would be disseminated in very different ways. The question of dissemination of infection by the wind seemed to him worthy of close investigation, and this should be carried out in the immediate neighbourhood of hospitals, as local drafts and eddies were of far more importance in a matter of this kind than any variations of wind recorded at Greenwich. Facts were still wanting in proof of "distal diffusion", and judging from the very marked exemption of streets and institutions in the direct line of supposed spread of infection, he was inclined to think such facts would not be forthcoming; but on that point observation alone could give a decisive answer.

February 9th, 1885.—Discussion continued.

Dr. BRISTOWE, in continuing the discussion, said he had put a few figures together referring to his district, which he would now present to the meeting. The parish of Camberwell was divided into six wards. Wards 1, 2, 3, 4, and 5 were the most populous, and ward 6 included Dulwich, which was the least populous. Ward 4 was situated on the eastern side of the parish; it formed a square, and it would be seen that the Deptford Hospital was placed against the centre of its eastern boundary. (A map was exhibited shewing the locality.) Ward 4 formed a small portion of the parish, but it was thickly populated, and largely by the poorer classes. The western part of the parish was, however, quite as closely populated, and, if anything, by a lower class of persons. In former epidemics, before the erection of the hospitals, when small-pox did occur it was generally scattered, but there was, if anything, an inclination to its prevalence in the western, rather than in the eastern, portion of the parish. He shewed, some years ago, that during the few years the Deptford Hospital had been open, more than half the total number of cases had occurred in No. 4 ward. In 1884 there was not a great deal of small-pox in the parish. He had gone beyond the year 1884, and had brought his experience down to the 7th February instant. During the year there were 241 cases—not, perhaps, a very large number, considering that the disease was so prevalent. The following Tables shewed the number of cases in 1884 and in the early weeks of 1885 in the several wards.

Small-pox Cases in Camberwell during year 1884.

	Ward 1.	Ward 2.	Ward 3.	Ward 4.	Ward 5.	Ward 6.	Total.
1st Quarter	0	0	0	0	2	0	2
2nd ,, ...	4	3	5	20	29	10	71
3rd ,, ...	3	4	2	50	29	10	98
4th ,, ...	6	7	8	34	6	9	70
Total	13	14	15	104	66	29	241

Small-pox Cases in Camberwell during first five weeks in 1885.

January 10	3	4	2	3	3	3	18
,, 17	2	0	1	5	7	4	19
,, 24	3	1	2	8	8	1	23
,, 31	0	1	1	10	4	1	17
February 7	0	4	3	20	4	1	32
Total	8	10	9	46	26	10	109

In the second quarter of 1884 the number of cases in No. 5 ward exceeded those in ward 4. There were some circumstances which might possibly account for this. There was direct communication between the East End of London, where at that time small-pox was prevalent, and No. 5 ward, by means of the railway under the river, and a great many workpeople came from the East of London who were employed in that part of Camberwell. But there was also a preponderance of the disease in ward 4. This might have been due in some degree to the same cause. He did not say that his former or present statistics, of themselves, proved that the outbreaks in No. 4 ward were due to the small-pox hospital being adjacent; and he had pointed out in his evidence before the Royal Commission that he was not at all satisfied that the cause of the spread of small-pox in Camberwell and adjoining parishes had been investigated so thoroughly as it ought to have been. It was a suggestive fact that ward 4 had its sewerage almost to itself, and that the Deptford Hospital drained into its main sewer, and he could not help thinking it by no means impossible that this had something to do with the epidemic prevalence of the disease in No. 4 ward. Asked by the President whether the disease had materially diminished last year, when in June the system of removing cases direct to the ships was instituted by the Metropolitan Asylums Board, Dr. Bristowe replied in the negative. In ward 4, in the quarter ending June, twenty cases were admitted into hospital, in the next quarter fifty, and in the last quarter thirty-four.

The PRESIDENT drew attention to the fact that the Deptford Hospital lay just off the Old Kent Road, which was the great thoroughfare through No. 4 ward for small-pox traffic to and from the hospital, and Dr. Bristowe said it was so.

Dr. SEATON hoped the enquiry would not be limited to the metropolis. There were, no doubt, many provincial members who would be glad to contribute. The question of "long diffusion" and "short diffusion" could be best studied from provincial experience. The discussion, up to the present time, had turned almost entirely upon the observations of those who had worked in the metropolis. He proposed, in the remarks he had to make, to take it into a fresh channel, and to discuss the question of the "aerial dissemination of small-pox" by the light of the experience to be derived from provincial towns. And first let him repeat and emphasise the remarks made by Mr. Butterfield on the difference in the conditions which existed in London and the country for the

study of a problem such as that which was under discussion. In this great metropolis there was no unity of government. In one parish the facts as to small-pox might be observed accurately, in another indifferently, and in a third not at all. The Sanitary and the Hospital Authorities were two different bodies, having only occasional intercommunication. The first intimation that the Medical Officer of a metropolitan district might have of a case of small-pox within his area might be a note from the Asylums Board that it had been removed to some distant parish. Again, in this great metropolis, there was no local public opinion worth speaking of; its inhabitants, especially those of the wage-earning classes, moved from one part to another, and were ignorant of the parish in which they resided, everybody's affairs were their own, and but few concerned themselves with those of their neighbours. Contrast with this the lively interest in local public affairs which every inhabitant of a provincial town had; the readiness with which each concerned himself about the affairs of other members of the same community; and the activity of the local press in diffusing information which was of local common interest. Again, there was, in every large town, a strong municipality, which regulated all matters concerning the health of the population. Serving this municipality there was the Medical Officer, who received information from all sources, and under whose guidance measures were taken for the prevention of epidemics. He received information from doctors, householders, and others; it was all immediately recorded in his office books. He had the control of the hospital, and by means of his telephone he was in frequent communication with the officials there. Through the local gossip he was made acquainted with facts gleaned at the time, which never would have been revealed by the patient or his friends. He was, in short, in the position of a scientific watchman, who, from the vantage ground of his office, was enabled to study the behaviour of an infectious disease like small-pox as no one else could study it. His (Dr. Seaton's) own observations with regard to the behaviour of small-pox in a large town were made at the end of 1881 and throughout 1882, in Nottingham, during the last epidemic there. His conclusions were such as would make it very difficult for him to believe in the aerial theory, in support of which the papers of Drs. Tripe and Gwynn had been written. As regarded Mr. Power's report, he yielded to no one in his admiration for it as a piece of work of great scientific value, and one which must always take rank among the best that had been issued by the Medical Department of the Government. But, as he had already said upon this question, the

observations made in provincial towns were, for the reasons given, likely to be even more valuable than those made in the metropolis. In a paper which he read before the Epidemiological Society at the end of 1882, and which was illustrated by means of numerous maps, he gave his reasons for not adopting the "distant aerial dissemination" views in preference to the old-established views on the subject of infection. He could not attempt now to do more than recapitulate the arguments against the aerial dissemination hypothesis. They were (1), that during the first five months the spread of the disease was to the north-east of the hospital, the west and the south being free—the south side, be it observed, including some of the poorest localities, where vaccination was often evaded and re-vaccination entirely neglected, (there being, during that period, 140 cases treated in hospital, and as many as 27 acute confluent and semi-confluent cases at one time); (2), the arrangement of the cases, those half a mile distant being more numerous than those close to the hospital; (3), the absence of any simultaneous outburst of cases, such as one might expect if the semina of small-pox were scattered in a still active state among a susceptible population; (4), the relation of cases to certain well-recognised centres of infection, as shown by the spot maps; this last being the most important consideration. On the other hand, in favour of the aerial dissemination view, and against his first three arguments, it was urged, by a local medical man, that the fact that the prevailing wind, during the first three months of the year, was from a westerly direction, while the west side was free, and the fact that, subsequently, after it had veered to the north, the south side became invaded, was evidence that the spread of infection was determined by the wind. As against this theory he pointed out, that, during the five months' immunity of the south side, there had been 28 days of calm, misty, foggy weather, such as Mr. Power considered as particularly favourable to the dissemination of small-pox material. But the real strength of his case lay in the minute history of the cases, and the details as to in-comings and out-goings in the home-treated patients. This he could only indicate on the map by coloured spots; but all those who worked with him were as strongly impressed, as he was, of the relation of all the cases to well-understood centres of infection. Here let him refer, in passing, to a leading article in the *Lancet* last June, which was anything but an impartial criticism of his paper. The writer, starting with a *petitio principii*, and assuming the aerial dissemination theory proved, referred to the fact that the proportion of cases to houses was greater

in the first than in the second rings; in the second than in the third; and quite ignored the points on which he had dwelt at such length, viz., the arrangement and history of the cases, and the fact that *the number of cases in the rings bore a relation also to the number of home-treated cases*. He now came to the consideration of facts, which seemed to trouble the distant disseminationists. He referred to the immunity of large establishments situated near to small-pox hospitals. He, himself, observed the facts as regarded three, viz., a workhouse, a school, and a factory. A good deal might be made of the immunity of the workhouse and school, but he preferred to dwell on that of the factory. Dr. Seaton at this point read the following extract from his paper above referred to:—"But by far the most remarkable case is that of Mr. Hodgson's factory, on the south side. This building is virtually in the hospital ground, the distance being only thirty yards from the nearest hut to the factory wall (photographs shown). Some of the windows on the second and third floors overlook the hospital ground, and a stone might easily be pitched from one of the 'doubler's' rooms into one of the hospital huts in which some of the worst cases were put during the epidemic. The factory buildings, however, are enclosed in such a way that there can be no personal communication between the workpeople and the hospital convalescents. During the year two persons working at this factory had been attacked. In one case the source of infection might be said to have been traced with a considerable amount of probability; in the other, it would be quite impossible for anyone to ascertain with anything like certainty the various chances of infection incurred twelve or thirteen days prior to the commencement of illness. When he visited this factory a short while before, it was for the purpose of finding out whether there were any persons who had not been re-vaccinated. The factory was not one of those at which he had himself addressed the *employés*, but, having regard to its very close proximity to the hospital, and to the danger which was supposed to exist in consequence, he fully expected to find that nearly everyone was protected against small-pox by re-vaccination. To his great astonishment he found that (excepting the Messrs. Hodgson) so far from being the rule, re-vaccination had been the rare exception; that a large number of the workpeople were very badly vaccinated, and that some were unvaccinated. In order to show the proportion of persons who might be looked on as susceptible to small-pox, he had drawn up a Table. In separating the vaccinated but unre-vaccinated adults into Classes (II and IV),

Table referred to in DR. SEATON'S *observations* (*pp.* 113, 115).

HODGSON'S FACTORY.—*Date of Examination, November 13th and 14th*, 1882.

Number of persons examined as to vaccination, 113.

,, refused to be examined, 4 { Said to have good primary vaccination ... ... } 3. { Said to be unvaccinated ... ... } 1.

Total number employed at date of examination, 117.

Number of persons employed during whole epidemic ... ... { November 1881, to November 1882, } 90.

Number of persons taken into employ during epidemic ... ... { Before September 1, 1882... } 20 { Since September 1, 1882... } 7 } 27.

Total number employed during whole or chief part of epidemic, 110.

Of the 90 employed during the whole time.

(*a.*) Completely or partially protected, 51.

CLASS I.—15. Adults revaccinated; under 15, with good marks.

CLASS II.—27. Adults with moderately good marks; under 15, with evidence of vaccination.

CLASS III.—9. Previous attacks of small-pox.

(*b.*) Unprotected or very slightly protected, 39.

CLASS IV.—34. Adults with bad marks.

CLASS V.—5. No marks, unvaccinated.

Of the 20 employed during the chief part.

(*a.*) Completely or partially protected, 11.

CLASS I.—5. Adults revaccinated; under 15, with good marks.

CLASS II.—6. Adults with moderately good marks; under 15, with evidence of vaccination.

CLASS III.—0. Previous attacks of small-pox.

(*b.*) Unprotected or very slightly protected, 9.

CLASS IV.—6. Adults with bad marks.

CLASS V.—3. No marks, unvaccinated.

Total number working in the factory during whole or chief part of epidemic, 110.

(*a.*) Completely or partially protected, 62.

(*b.*) Unprotected, or very slightly protected, 48.

he had been guided not only by the number and size, but also the character of the marks as regards their foveated and depressed condition. This division was, of course, somewhat arbitrary; some of those placed in Class IV might by others have been placed in Class II, and *vice versâ*; but he had tried to represent the facts as fairly as possible. Now, the number of patients at the hospital huts was at one time as many as seventy-eight. The proportion of acute cases was, of course, constantly varying, but in one week there were as many as thirty-two fresh cases admitted. At the lace factories the work is carried on at night as well as in the daytime. During the eleven months the 'hands' must have been working there under every conceivable variation in atmospheric conditions. They were there during the still, cold, foggy weather of December and January, during the early spring, when the high winds blew from the west, in the hot days of June and July, in the still summer evenings, and again in the early morning, when the dew was rising from the earth. They were there in damp and dry states of the atmosphere, when ozone, according to Schönbein's test, was present in large quantities, and again when it was absent; when the electrical condition must also have varied; when the wind was from the north, the south, the east, and the west. Had fourteen of these forty-eight persons been for twenty-four hours in the 'skin ward' with a case of small-pox, as the people were over the way on November 24, it is highly probable that, as had happened then, about half of them would have contracted the disease. On the hypothesis of aerial infection, and having regard to. the close proximity of the hospital, it is certainly very difficult to account for the immunity of these forty-eight persons during the whole epidemic."

In concluding, Dr. Seaton said this question ought to be specially studied in the provincial towns and country places, where hospitals exist near to populations. Dr. Bridges had divided them into two classes, "long" and "short diffusionists". But he had not told at what point of distance in aerial dissemination he considered that the short diffusionists end and the long diffusionists began. For his own part he could hardly consider himself either a long or a short diffusionist. For as he knew that the infectious material of small-pox would travel the length of a ward 100 feet long, so he should find it difficult to disbelieve that, under certain circumstances, it might travel as far in the open air outside the ward. And as a believer in the particulate matter of the contagion, he could suppose it possible that it might be borne greater distances under certain rarely existing

conditions of the atmosphere. But from an actual observation of facts, he should be of opinion that with the intervention of 100 feet of open air, the risk of the spread of infection from a hospital ward was slight; and that at the far greater distances which they heard talked of now, the danger, if any, must be so infinitesimal as for all practical purposes to be safely disregarded.

Dr. ALFRED CARPENTER said the infectious wards at Croydon had been referred to somewhat as giving proofs of the possibility of aerial dissemination.* He had enquired into the matter on the spot, and he had found from personal examination, and as the police say, "from information afforded", that whatever might have happened by which small-pox was diffused by these wards, it was by means of personal communications, and not aerial dissemination, in the strict sense of the term. These wards were in close proximity to the workhouse, having been erected upon a part of the garden, and the Guardians had control of them in opposition to his individual view, for he had pointed out, when they were enlarged some years ago, and in that view he was recently supported by Dr. Bridges, that the management of infectious wards ought to be in the hands of the Sanitary and not of the Destitution Authority. What had those sapient people done? They had utilised a portion of the circumjacent area as a stone yard; there were recently 180 men at work in that yard, which was only separated from the small-pox hospital by a wall nine feet high, and there were heaps of stones in the yard as high as the wall. To get into this stone yard the men had to pass along a road which was separated from the hospital grounds only by a fence about four feet high, so that the small-pox patients were on one side and the workmen on the other as they passed to and from the yard. The consequence was that there had been a diffusion of the disease by those men; and he thought that to assume that there was a case of aerial diffusion would be assuming too much. There were three cottages on the other side of the road, a very few feet from the airing ground of the hospital, and cases were generally reported as arising in these cottages when the wards were occupied. It was evident that there had been surreptitious personal communication between these houses and the wards by various means. He suggested to the Guardians that they should stop communication with the outer world, but they said "we cannot do that, if we did, we should not get nurses at all". The head nurse, about two years ago, permitted, one night, a friend of hers who was unvaccinated to

* *Vide* Note by Dr. Philpot, M.O.H. for Croydon, p. 130.

sleep in the hospital, and afterwards she went away and died of the disease in another district. Whilst they had authorities having the care of buildings of this kind who acted in such an absurd way, it was quite certain that the small-pox would not be stopped by any other means than vaccination. That there was intercourse with the outer world, in this and similar cases, was certain from the enquiries which he made when acting on the Royal Commission. The answer to his enquiries always was that they could not shut out that intercourse with the outside world, and not all the arrangements which could be made would entirely prevent it. With regard to the question of aerial diffusion, he must confess that he believed in it in a very modified way only. The evidence given before the Royal Commission led him to come to certain conclusions, and the experience which he had had of examining into the subject since that time had satisfied him that he had good grounds for his ideas. He wished them to look at the subject from a natural history point of view. He considered that the disease was propagated by particulate matters, produced by a living organism, allied to the fungals and algals, so far as regards propagation, that is, that there were two forms of germs by which the disease might be propagated. Let them look at the particulate matter as seeds: he took it that one form of those seeds could be carried about any distance; if it were by atmospheric means, it would depend upon the arrangements in force in the hospital, but any hospital management which allowed scabs to be carried away and disseminated by air, would be faulty in its duty. The medical superintendent must always take care that the particles or scabs were not carried away. Of course there would be no fructification of those seeds until they got to some soil where they might grow, and undergo the usual stages of incubation. When sitting on the Royal Commission it became quite evident to him that the most infectious stage of the disease was the feverish stage, and that if a person susceptible to the disease entered into a small-pox ward containing feverish cases, although not going near the patients, he would be infected; the reason for this arose from the fact that the mucous membrane of a small-pox patient gives off organic matter, which corresponded to seeds which had already sprouted. If they took these germs as they came from the breath of a feverish patient, or as they floated in the air and came in contact with the eye, the throat, or the bronchial membrane, and found their way into the system, they would immediately fructify and infect the patient. He thought they might be carried through the atmosphere for some

distance, if there was no ozone in it, and, at the same time, an excess of carbonic acid gas ; but if the sprouting seeds did not come into contact with other living and susceptible organisms, as mucus surface, very rapidly after diffusion, he thought the action of the air would kill the organism, and prevent its power to fructify. In referring to the subject of the conveyance of patients by ambulances, the speaker mentioned the fact of people standing round the ambulances, and thus taking the disease, by inhaling these living growing organisms from the breath. Dr. Bristowe had mentioned sewage as a possible cause for extension, and he thought there might be something in that, but not that sewage *per se* was a means of spreading small-pox; it was a point upon which he made enquiry before the Commission, but there were no proofs of its alliance. He scarcely ever failed to find personal communication. There was the case of the man admitted into the Epsom Workhouse, and dying after the operation of tracheotomy, it was supposed from laryngitis, small-pox having been only suspected as a part of his illness. Within fourteen days of his death, seven or eight cases were admitted into the small-pox wards from the villages in the neighbourhood, and it was found that the man (who was a travelling tinker) had been sleeping at the houses from whence the cases came. That was, perhaps, a sample of many similar cases, which were apparently aerial in their diffusion, but which could be explained as caused by personal contact if they could only be traced.

Dr. C. E. SAUNDERS, having charge of a district on the verge of the metropolis, and extending thirty miles, said he had no difficulty in tracing the cases of small-pox, and there was no spread except when there was contact with others. In 1884 they had 19 cases, all intensely acute, and all within a week, which were treated in the houses. As to the broad question of long aerial diffusion, he had difficulty in accepting it. If it was true, he did not think they would have to go to special pleading to bring forth its truth. If the infection could be blown half-a-mile, he did not see why it could not go thirty miles. If there was truth in the theory, it was rather extraordinary that anyone escaped the disease at all. Dr. Carpenter had referred to carbonic acid gas as having something, perhaps, to do with the carrying of the germs, but the presence of the gas in the atmosphere hardly varied.

Mr. G. W. COLLINS referred to the Fever and Small-Pox Hospital, at Hampstead. There was no personal communication between the two hospitals, and there had been no cases of small-pox in the fever hospital, except two cases, which were accounted for. If the disease

was communicated by the air, it ought to have been carried so short a distance. One of the exceptional cases was by means of a letter, which had carried the contagion.

The PRESIDENT, in summing up the discussion, said it was admitted on all hands that there was an undue prevalence of small-pox cases in the vicinity of small-pox hospitals. Dr. Wilson had asked in his paper whether the hospitals were the cause *per se* of that undue prevalence? Practically, Dr. Tripe and Dr. Gwynn had answered "yes". In a word, they adopted the theory of distal aerial dissemination of *contagium*, broached by Mr. Power, and they found in that theory a sufficient explanation of the occurrence of small-pox cases at considerable distances from, as well as near to, the hospitals at Homerton and Hampstead. If this theory did indeed furnish the true explanation of the spread of small-pox in the vicinity of those and other hospitals, it would be difficult to justify the retention of hospitals for small-pox in London, unless it could be shown that there might be even greater danger to the public in the treatment of cases in their own homes. According to Dr. Gwynn, there was no special significance in numbers, and a single case might be the cause of small-pox to susceptible persons within the "striking distance" of atmospherically conveyed *contagium*. The issue raised was very serious, and it justified the time and attention devoted by the Society to the attempt to arrive at a correct solution of the question propounded by Dr. Wilson. For his own part, he was still in the position of being unable to accept the aerial theory as commonly understood, and still thought that the prevalence of small-pox in the vicinity of the hospitals admitted of another explanation. To his mind, the experimental experience acquired in relation to public institutions within the special area (*i.e.*, within one mile) of a hospital negatived the new theory. The inmates of such institutions, as they had learned in the course of the present discussion, enjoyed practical immunity from small-pox. It was not that small-pox was unknown among them, but the cases were few and rare, and such as occurred were often susceptible of explanation in "commonplace ways". The disease entered by the gates, and did not leap over the walls or fly in at the windows. Stop personal communication, and you stop small-pox. There were isolated localities near small-pox hospitals, moreover, off the line of common traffic, which were commonly free from small-pox, as compared with equally near localities on the lines of traffic leading to the hospitals. The disease in the special area usually appeared at a distance from the hospital, and then closed in.

It converged, so to say, and did not diverge from the hospital. Facts of this kind, which were notorious, appeared to him to be fatal to the theory of distal aerial dissemination. That theory had been broached by Mr. W. H. Power as a result of his inquiry relative to the spread of small-pox in the vicinity of Fulham small-pox hospital. Mr. Power had felt constrained to entertain it in order to account for the occurrence of what he called a "notable outburst" in the special area in January 1881. The facts of that outburst were as follows:— Fulham Hospital had been opened in the middle of December 1880, and by January 8, 1881, 32 acute and 110 convalescent cases had been admitted. Of the acute cases, four belonged to the borough of Chelsea, which comprised the parishes of Chelsea and Kensington, and the Fulham Union; two came from within the special area, *i.e.*, from within a mile of the hospital. In the two weeks, January 9-22, some 48 acute, and 22 convalescent cases were admitted; seven of the acute cases were Borough cases, five belonging to the special area. No particular importance was attached to the above local cases. But, says Mr. Power, "in the next succeeding fortnight (January 23, February 5), a very unexpected event took place—a great outburst of small-pox in Chelsea, Fulham, and Kensington. Fresh cases rose at a bound to 62," including 47 in the special area; 56 houses were newly invaded; the houses newly invaded in the special area being 41. Of the 62 cases, 42 were attacked on five days (January 26-30), 32 of them in the special area. In regard to nine of these 32 cases, a reasonable explanation of their occurrence was forthcoming, but of the other 23 cases, infected January 12-16 (five days), "there was scarcely a hint to be got to account for their illness". The houses newly invaded in the next fortnight, Feb. 6-19, were 28, including 21 in the special area, or just half the number invaded in the antecedent fortnight. Nothing like the "notable outburst" of January 26-30 subsequently occurred. Compare with that outburst the outbreak in June 1884, to which he had previously referred (*vide* p. 107). The facts could not be stated with the same completeness by him, but in due time, doubtless, they would be published by Mr. Power. The hospital was opened May 17; two patients were admitted on that day. By the end of May eleven borough of Chelsea cases had been received, but none of these could have been infected by hospital cases, for at the dates of infection there were no cases in the hospital. Seven of the cases came from Kensington, three from Chelsea (including two from the Kensal Town district, situated to the north of Kensington), and

one only from Fulham. Prior to May 31, Kensington recorded cases in 1884 were 23, 13 in North and 10 in South Kensington. Of the 13 cases in the North, 12, in 11 houses, occurred in May. Of the 10 cases in the South, three, in one house, occurred in May; the first of these three cases was not recognised, and the patient went about as usual all through her so-called illness. In the two weeks, May 19, June 1, "a very unexpected event took place—a great outburst of small-pox in Chelsea, Fulham, and Kensington. Fresh cases rose at a bound" to 52; 47 of them having been admitted into the hospital, and five in Kensington having been treated at home. Chelsea contributed 8 cases, Fulham 11, and Kensington 33. Of the 52 cases, 26 were infected in the four days, May 19-22 (10, 8, 3, and 5), and of these 26, 22, in 22 houses, were Kensington cases, of whom 16 had resided within the special area, and five others between one and one and a half miles from the hospital. Of the 16 cases within the special area, one resided in the quarter-mile central circle, and 6, 6, and 3 in the three outer quarter-mile rings. The significance of the figures would be realised when it was remembered that out of 32 cases in the special area infected January 12-16, 1881, only 12 belonged to Kensington, and that the admission of some 70 acute and 120 convalescent cases into the hospital previously had not, apparently, done any mischief in the district, whilst in June 1884, no fewer than 16 cases in the Kensington part of the special area got infected in four days, although, on the last of the four infection days, only five cases in all had been admitted into the hospital, which stood on a site six acres in extent, and at a minimum distance of 300 yards from the nearest houses in Kensington. Time did not permit of further reference to this outburst, which appeared to him to neutralise all the inferences Mr. Power had drawn from the earlier outbreak, for it could be shewn that the cases were no more explicable than those in the special area in January 1881, or than those in an equal "notable outburst" at the culmination of an epidemic in April 1878, to which he had referred in his evidence before the Royal Commission. He submitted, however, that there was no possible ground for attributing the occurrence of the cases, in 1884, to any hospital influence. The epidemic wave appeared to him to have spread from north to south, from east to west, and, subsequently, Chelsea and Fulham cases became relatively more numerous. Dr. Tripe had accounted for the sudden outburst of small-pox at Homerton, in March 1884, on a theory of "eddies" in the atmosphere, which, he believed, had whisked the poison out of

the hospital windows and deposited it among susceptible people in the district around the hospital. The eddies referred to had been recorded at Greenwich and, as he understood, at Kew also. They must have operated in the districts of Stockwell and Deptford Hospitals, but they had not produced any spread of small-pox in those districts. The epidemic broke out in Hackney, as they knew, but not there alone, for cases were occurring simultaneously in the parishes of Islington, Bethnal Green, and Shoreditch. He had prepared Tables shewing the incidence of small-pox in every district of London for the greater part of the year, as indicated by the admissions into the hospitals, and at another time he hoped to place those Tables in the hands of the members. They shewed that small-pox had lingered in Hackney all through the winter, and that the disease was nowhere else so severe as in that parish all through the epidemic of 1884. From that district it had spread in all directions, until every part of the metropolis had become invaded. In a twelvemonth there had been 1,200 known cases of small-pox in Hackney, and of these some 250 (besides concealed cases) were treated in their own homes. Dr. Tripe had referred to a group of 50 cases traced to one home-treated case. What mischief might not 250 home-treated cases have done in such a locality! Between the end of October 1883 and the end of September 1884, some 4,352 cases had been treated by the Asylums Board ; 791 of the cases had been admitted direct into the ship hospitals, and 3,561 into the London hospitals. Of the 3,561 cases, no fewer than 2,107 had been admitted into Homerton Hospital, as against 1,462 admitted into all the other hospitals, five in number. The great bulk of the 2,107 cases were transferred to the ships and to the Darenth Camp at an early period after admission into Homerton Hospital. The Homerton, the Stockwell, and the Deptford Hospitals were, as he had said, open in March 1884, at the time of the primary outbreak in the eastern and northern districts. The prevalence of small-pox in those districts had caused the opening of the ships in February. In April, Darenth Camp and Hampstead Hospital were opened. In May and June, the Fulham and Plaistow Hospitals, respectively, were opened ; the several hospitals having been opened to meet the requirements of the districts, west and south, as the disease spread to them from the east and north. In June, a momentous change of practice was initiated by the sending of "mild" cases to the hospital ships direct from their homes. Previous to this, and in four successive fortnightly periods, beginning April 26 and ending June 20, 285, 219, 409, and

319 cases had been admitted into the Homerton Hospital; and in the same fortnightly periods 267, 194, 382, and 281 cases had been discharged from the Homerton Hospital to the hospital ships or to the Darenth Camp. Reflect for a moment on these figures. In the two weeks ended May 9, 552 cases of small-pox had entered or left the hospital, and 413 in the two weeks ended May 23. In the next two weeks, ended June 6, the small-pox traffic culminated, no fewer than 791 infectious persons having entered or left the hospital; while in the two weeks ended June 20, when a proportion of the cases were, for the first time, sent direct from their homes to the ships, the number of entering and leaving patients fell to 600. From this date, June 20, a most active system of removal of cases direct to the ships began, and in the two weeks ended July 4, no fewer than 257 cases were so removed. Of course what follows [illegible]

The Tables referred to on the opposite page (122) will be found on pages 130A—130L.

admitted in 14 weeks, moreover, fell to 72, as against 665 in the previous 16 weeks, when all the cases were first admitted into the hospital before transfer to the ships. The question would naturally be asked whether the instant and decisive reduction in the number of cases after the middle of June, was a coincidence merely, or a consequence of the new arrangement by which patients were admitted direct into the hospital ships without having been taken through the streets converging upon the Homerton Hospital? He referred to this hospital as furnishing the strongest illustrations, but it would be understood that the same system of direct removals was in general practice, and was attended with the same results in other districts, but the other hospitals had admitted few patients compared with the multitudes admitted into Homerton. A comparison might contribute to the solution of the question. In the early months of

1881 small-pox was rampant in London, the hospitals were full, and many cases were left at home for want of room. At about the middle of May, pressure was relieved by the opening of the Darenth Convalescent Camp Hospital, but the hospitals in town, which contained about 1,000 beds, were kept filled with new cases as fast as recovering cases (called convalescents) could be transferred to the camp All cases in that year were first sent to a town hospital, and transferred, when convalescent, to the camp or to the ships. There was thus a great amount of movement of small-pox cases, in the vicinity of the hospitals, after Darenth was opened, and the epidemic continued to increase, there having been no sensible reduction in the number of cases admitted into hospitals until the end of June. The effect of the system of direct removal of cases to the ships, initiated in June 1884, had been to diminish the amount of convergent and divergent small-pox traffic in the vicinity of hospitals. Such traffic increased indefinitely the opportunities for infection, and it was a question whether it did not suffice to account for the spread of small-pox in the vicinity of hospitals, and for the continuance of epidemic small-pox in London? They knew, at any rate, that when opportunities for contact were reduced to a minimum, as in the cases referred to of public institutions under efficient control, then small-pox did not prevail, even when such institutions were well within the (supposed) "striking distance" of the small-pox poison. The Asylums Board had published a return of small-pox cases admitted into their hospitals during the quarter ended December 31, 1884, the total number being 2186, and he could not discover there any evidence of excessive prevalence in the parishes in which hospitals were situated. On the contrary, the disease had been far more prevalent in parishes which contained no hospital, than in parishes situated within the "special areas" of hospitals. It would be impossible, however, for any one but the local Medical Officers of Health to say whether the proportion of cases in the immediate vicinity of hospitals was excessive as compared with other parts of the same parishes. If it was excessive there, and not elsewhere in the same parish, it would seem to show that small-pox traffic was in some way the cause of small-pox spread. He did not mean to assert that the disease was spread by the patients in the ambulances, though spread in that way would be practicable, and was more probable on the "short diffusion" theory. He simply wished to point to the desirability of limiting, as much as possible, the concentration of small-pox traffic in the vicinity of hospitals, believing that the

thinner the line of such traffic anywhere was, the less danger would there be of the spread of disease in the districts where it took place. He could not conclude without a reference to the views which had been expressed as to the relative dangerousness of the acute and the convalescent stages of small-pox, regarded as factors in the spread of disease. Mr. Power, as they knew, attached no importance to an accumulation of convalescent cases, and hitherto his views seemed to have been justified by the experience acquired at Darenth, just as they appeared to have been justified by what happened at Fulham. But in the course of the action, Fleet *versus* the Managers, relative to Darenth, and in the course of the present discussion, numerous experienced medical officers of health and others had asserted that the convalescent, or scabbing, stage was not less infectious, and, therefore, not less dangerous, as a source of infection to others, than the acute stage. All convalescent cases had been removed by the Board in their own ambulances. Was this the cause of the impunity with which the removal of such cases to Fulham and Darenth had been carried out? Surgeon-Major Pringle's observations with regard to the scabbing stage were very interesting, and they suggested two precautionary measures in hospital management, viz., the insertion of perforated screens in window openings, and the use of disinfectant unguents for the skin. But, to conclude, enough had probably been said to satisfy the Society that the case against the hospitals, on the theory of distal aerial infection, had not been made out, and to shew the necessity for further observation and definite enquiry before a final and satisfactory verdict could be given. At the same time it must be remembered that, if personal communication were a sufficient explanation of the spread of disease in the vicinity of hospitals, a very grave responsibility attached to all who were in any way connected with the administration of those institutions. It became a vital question, moreover, whether such spread was, or was not, wholly or partly preventable? This question, however, was too large to be entered upon at the present time, but the ground for a consideration of it would be cleared, could they be satisfied that the theory of aerial dissemination, in the sense of Mr. Power's report, was, as he thought, untenable.

Dr. GWYNN waived his right of reply, the hour being late, remarking that the President had summed up very fairly, and that the aerial theory must be admitted to be "not proven".

Dr. Tripe's absence precluded him from replying.

Appendix.

Memorandum on the Influence of the Small-pox Hospitals, etc., for the information of the Society of Medical Officers of Health, by Henry E. Armstrong, *Medical Officer of Health to Newcastle.*

I have had charge of the Fever and Small-pox Hospitals since 1868, and of the Small-pox Convalescent Home for about ten years. (The last named has only been used in 1871-2 and 1882-4.)

The present population of Newcastle is over 153,000.

The old Fever and Small-pox Hospital at Bath Lane is near the centre of the city, and in a densely populated neighbourhood. The Small-pox Convalescent Home is on the outskirts. It contains 33 beds. The small-pox block at Bath Lane was closed in 1882, and a new small-pox hospital was opened on the Town Moor.

The area of the Bath Lane Hospital premises is only 3 roods, 28 perches, and that of the Convalescent Home is about 2 acres. The hospital consisted, in 1871 and until 1882, of two blocks, and contained, in 1871 and for some time after, beds for 60 patients. Both were occupied by small-pox cases in 1871-2. The block now closed was used for small-pox until the time of its discontinuance.

The chief reasons for closing the old small-pox block at Bath Lane were general unfitness, and because of its being in the same grounds as, and very close to, (only about 20 feet distant from), the fever hospital, so that the fever convalescents could not exercise without coming very near to the small-pox wards, and risk of meeting persons coming directly from these wards. The closure of the latter was helped on by the occurrence of some cases of small-pox in an adjoining street, (Stowell Street, further reference to which will presently be made), at the time when the charges were being brought against a small-pox hospital in London as having infected its neighbourhood.

The grounds of the Bath Lane Hospital are enclosed by walls of from 6 to 9 feet high; the Convalescent Home and new Small-pox Hospital by walls or fence of 7 or 8 feet high.

The small-pox block at Bath Lane (now disused) is 55 feet distant from dwellings in Stowell Street, and the deadhouse is only 40 feet from houses in the same street. The Byker Convalescent Home has dwellings abutting on the premises, and is separated by a roadway only from a group of houses known as Byker village.

From January 1871 to October 1872, 896 patients suffering from small-pox were treated at Bath Lane Hospital.

During the epidemic cases occurred in Stowell Street, but the number known was not marked, and, proportionally, not so great as in similar streets in other parts of Newcastle. Cases from this street were admitted to hospital when the wards were beginning to fill, but the number of these subsided as the wards became full, and ceased altogether for a period of four months, when the wards were in active occupation.

The monthly admissions to hospital reached 85 in May 1871. Small-pox then was admitted for the first time from Stowell Street; (six cases in a total population, of the tenement class, of above 600 persons, living on an area of about two acres). In June one case, and in July four cases, only of small-pox were admitted from this street, although, in these months, the admissions to hospital were, respectively, 130 and 108. After this date, notwithstanding the great prevalence of small-pox until the end of 1871, (the monthly admissions to hospital having only once been less than 60 per month), two cases only from Stowell Street were received up to the termination of the epidemic in October 1872. These were one in December 1871, and one in February 1872.

In 1882 small-pox appeared in Stowell Street at the time when the wards of the small-pox block were in use. The origin of the first case was not ascertained, but the subsequent spread of infection from it was traced to communication, or direct contact, between the infected and others, in a closely confined court of tenemented houses, several of which opened into the same interior passage. It should be observed that, although the first case in 1882 in this court was not traced, the disease had appeared there about a year before, owing to infection brought by relatives directly from a beerhouse in a different street.

There were, in all, 28 cases in and near Stowell Street in 1882. Seeing the closeness of the dwellings and the character of the population, this number of cases—apart from hospital considerations—is not surprising, and is not so large, proportionally, as in parts of the town more distant from the hospital. Significance was given to the occurrence of disease here by the publicity given to the subject of hospital-influence in London.

The circumstance of coincidence in point of time, as above described, is the only argument in support of the cases, or any of them, having been due to infection emanating from the hospital. If such

emanation had taken place, it would persumably have affected a larger number of persons, owing to the density of population and nearness of the street to the hospital.

The present Small-pox Hospital on the Town Moor (24 beds) is about a quarter of a mile distant from streets and dwellings, among which are included the military barracks for about 1,000 soldiers. Some of the streets are densely populated. Although the hospital has been in active operation since 1882, no complaint has been made against it. There have been, it is true, one or two cases of small-pox in the barracks, but these are known to have been imported from neighbouring towns.

In 1871-2 the Small-pox Convalescent Home was, for a considerable part of the epidemic, filled with cases. The exact numbers are not known to me, as I had then no charge. I believe that, for some time, there were as many as 60 convalescents there at a time. Yet there is not known to have been any small-pox in the adjacent dwellings, (Byker village).

In 1882-3, although the home was not so crowded as in the former epidemic, yet there were sometimes over 30 convalescents together, but no cases are known to have arisen near the home. (I believe the scabbing stage to be highly infective.)

In reply to the queries forwarded by the Honorary Secretaries (*vide* p. 131), I have to state as follows:—

(1) There has not been what I consider a "special incidence" upon the area round any of the small-pox hospitals in Newcastle.

(2) In at least one of the cases occurring in the vicinity of the Hospital at Bath Lane, there is reason to know that infection was conveyed by personal intercourse. The spread of the disease in Stowell Street generally, in my opinion, was due to personal communication.

In 1882 a disease map was prepared with circles of one-eighth, a quarter, and a half-mile radius, respectively, round the old small-pox block at Bath Lane as a centre. In the innermost portion there were 42 known cases of small-pox; in the middle portion, 57; and in the outer portion, 95. The areas of the three portions, proceeding from within outwards, are, respectively, in the ratio of about one, three, and twelve; and their known cases of small-pox in the ratio of three, four, and six. The population of the three areas not being accurately known precludes calculation of rate of incidence of disease to inhabitants. The population is dense throughout the entire circle of the half-mile radius, with the exception of some (comparatively little) open ground.

(3) The Infirmary is about one-third of a mile from Bath Lane Hospital. So long as Bath Lane Hospital was in use for small-pox there had been no small-pox at the Infirmary. Last year (two years after the Bath Lane small-pox wards were closed) small-pox broke out in the Infirmary, causing some twelve cases, for which no satisfactory cause had been ascertained. Had the small-pox wards at Bath Lane been in use, they might have been blamed.

Note by Dr. WALTER VERDON, *Medical Officer of Health, Lambeth.*

The epidemic of small-pox in 1884 commenced in Lambeth on April 16th, and continued until August 29th. Only two or three cases occurred between January and April 16th, and after August 26th no cases were reported until the end of September. During this short epidemic 140 cases were reported. Between April 1st and August 27th the number of cases in the Stockwell Small-pox Hospital ranged between 20, the lowest number, and 53, the highest number, under treatment at the same time, the average number being about 35 cases.

Of the 140 cases above mentioned, 31 cases occurred within the one-eighth mile radius, 19 occurred between the one-eighth mile and quarter-mile radius, and 14 cases occurred between the quarter and half-mile radius, making a total of 64 cases occurring within half a mile of the hospital. The remaining 76 cases occurring at distances varying from three-quarters of a mile to two and three-quarter miles from the hospital.

There is one point of interest in the situation of the small-pox hospital which is worthy of note. The railway line running from Brixton to Clapham lies south of the hospital, and bisects both the half and quarter-mile radius. There is no direct means of transit between the north and south sides of this line, between the two points where it bisects the quarter-mile radius; and a greater part of the south section of the half-mile area is also cut off from any direct communication with the hospital approaches by this line of railway. The lines of sewage are divided as well as the roads. Now in this area so cut off from the hospital, during the whole of the epidemic, only three cases occurred.

I think this point is one of great interest, as this line of rails is not many feet above the level of the surrounding ground, where it bisects the quarter-mile area; and we find on the one side 49 cases, and on the other side of this line only one case within this area. I

think it is a fair inference that the want of continuity of road and sewer communication may have some part in the unequal distribution of the disease, and this barrier could scarcely interfere with the dissemination of the disease through the air.

Dr. C. W. PHILPOT, of Croydon, wrote: "I have maintained for several years that small-pox has been spread from the small-pox wards to Pawson's Road, Croydon, and to the cottages in the short road leading to the Gravel pit . . . . The distance from the wards to the nearest houses (Lion Cottages) is only 200 feet. Only small-pox cases removed from the northern (or Norwood) part of the district would pass the northern or inhabited part of Pawson's Road; the majority of cases, *i.e.*, those coming from Croydon Town, the most populous part of the district, would not pass the houses in the road but by the cemetery. I have known at least seven occasions on which this has occurred. Pawson's Road has suffered from small-pox out of all proportion to any other road of the same number of houses of the district, and this not once, but whenever small-pox has been in the district and in these wards; as a rule, if cases of small-pox are taken to these wards, within two or three weeks small-pox will break out in Pawson's Road; the houses nearest to the wards have suffered most. The nurses are allowed to go out occasionally, but I have never been able to make out that they visited any people in Pawson's Road; they have always denied it, and I have never had reason to doubt the correctness of their statements. Visitors are only allowed in the most urgent cases. The wards are in two storeys, and the walls are 12 feet high. It would be very difficult for convalescents to have any communication over the wall with persons outside. I knew one case of a man getting small-pox when working in the market garden close by; I could trace no other source of infection. Our facts are in favour of the theory of aerial dissemination of small-pox." (*Vide* Dr. A. Carpenter's observations at page 116.)

Dr. DON BAVAND, who has had charge of the above hospital, says: "I have little doubt in my own mind that the hospital is a great source of danger to those parts standing to the north; but, strange to say, in the fever hospital, which only stands a few yards to the south, no case of small-pox has occurred to my knowledge. There has been no outbreak in the house or any other of the buildings. The house stands in about six acres of ground, and is distant from the small-pox hospital about 180 yards; the temporary wards are about 40 yards nearer, and are full of infirm paupers."

THE SMALL-POX EPIDEMIC OF 1884.

NOTE BY THE PRESIDENT.—Towards the latter end of 1884, and before the recrudescence of the epidemic, I prepared the subjoined Tables, A to K, based on the fortnightly returns of admissions at the hospitals, with the view to inform myself as to the origin and the progress of the epidemic. They are the Tables referred to in my observations at page 122 *ante*, and are reproduced from my Annual Report for 1884.

Small-pox, it will be seen, was at low ebb in November, 1883, when the Tables begin, and the epidemic, which commenced in March, 1884, had practically terminated in September, when the Tables end; at which time, moreover, the Asylums Board ceased to publish detailed returns of admissions and movements of small-pox cases.

The evidence furnished by the Tables shews that the epidemic started at Hackney, and in adjoining districts, north and east, and thence spread to other parts of the Metropolis; that it reached its maximum in June, and that the subsequent marked and rapid subsidence of the epidemic was coincident with the adoption of a system of direct removal of patients from their own homes to the hospital ships, by means of which the convergent and divergent traffic of small-pox in the vicinity of the hospitals was reduced to a minimum.

The Tables must be studied in connexion with my observations in the discussion on Small-pox Hospitals (at page 119 *ante*), and also, I would add, in connexion with the observations on "The Small-pox Epidemic of 1884," and on "The Use and Influence of Hospitals for Infectious Diseases" at page 43 and page 61 in my Annual Report for 1884.

In connexion with the observations (at page 130) by Drs. Philpot and Don Bavand on the influence of the Small-pox wards at Croydon on the surrounding district, the following extract from a letter I received from Dr. Philpot subsequently will be read with interest:—

> "You will remember I sent you some facts relative to the spread of Small-pox from our Small-pox wards into the houses of the neighbouring road. I find these are not as important in their bearing on the subject as I thought at

the time. I have since discovered that there has been on the sly a good deal of intercourse between the wards and the road. I had the place watched by a sanitary inspector, and from what he saw and what I have since heard, the wards have not been as much isolated as I thought, or as they ought to have been. I am happy to say that now a more stringent regime is likely to be introduced."

Dr. Philpot's very candid note is highly suggestive.

TABLE A.—Shewing the number of Patients remaining under treatment at each of the Hospitals at successive fortnightly dates :—

Date.	Designation of Hospital.								Total.
	Eastern.	South Western.	South Eastern.	North Western.	Western.	Plaistow.	Ships.	Darenth Camp.	
1883.									
Nov. 9.....	30	5	...	...	...	...	...	...	35
„ 23.....	46	3	...	...	...	...	...	...	49
„ 7.....	60	11	...	...	...	...	...	...	71
„ 21.....	66	20	...	...	...	...	...	...	86
1884.									
Jan. 4.....	61	36	..	...	...	...	...	...	97
„ 18.....	69	36	Opened Jan. 5	...	...	...	...	...	105
Feb. 1.....	83	25	6	...	..	...	Opened Feb. 9.	...	114
„ 15.....	42	19	12	...	...	...	42	...	115
„ 29.....	34	13	12	...	...	...	80	...	139
Mar. 14.....	23	12	13	...	...	...	105	...	153
„ 28.....	44	21	25	...	...	...	174	Opened April 3.	264
April 11.....	54	23	12	...	...	...	146	100	335
„ 25.....	43	16	22	Opened May 6	...	...	144	114	339
May 9.....	47	41	27	11	Opened May 17	...	178	409	713
„ 23.. ...	49	27	27	31	5	Opened May 31.	136	599	874
June 6.....	36	34	32	25	28	32	116	769	1,072
„ 20.....	43	32	32	18	29	11	214	932	1,311
July 4.....	33	23	39	23	31	11	222	996	1,378
„ 18.....	20	25	29	11	22	24	168	864	1,163
Aug. 1.....	17	20	19	8	16	11	105	735	931
„ 15.....	26	11	16	5	13	13	124	454	662
„ 29	21	12	12	8	3	6	94	395	551
Sept. 12.....	20	14	10	18	2	12	80	332	488
.. 26.....	14	11	12	15	3	28	102	332	517

TABLE B.—Shewing the number of Acute Cases *admitted* at the several Hospitals in successive fortnightly periods.

Fortnight ended.	Designation of Hospital.							Total.
	Eastern.	South Western.	South Eastern.	North Western.	Western.	Plaistow.	Ships.	
1883.								
November 9.....	3	2	..	...	...	...	...	5
23.....	30	3	...	...	...	...	...	33
December 7.....	28	9	...	...	...	...	...	37
„ 21.....	33	11	...	...	...	...	...	44
1884.								
January 4.....	13	17		...	...	...	...	30
„ 18	27	6	Opened Jan. 5	...	...	...	...	33
Febr ary 1.....	35	5	5	...	...	...	...	45
„ 15.....	23	1	7	...	...	...	...	31
„ 29.....	44	5	3	...	...	...	...	52
March 14	44	4	4	...	...	...	...	52
„ 28.....	136	14	13	...	...	...	...	163
April 11.....	102	8	3		...	...	...	113
„ 25.....	123	9	12	Opened May 6	Opened May 17	...	...	144
May 9.....	285	37	18	12		Opened May 31	...	352
„ 23.....	219	9	25	44	6		Sick sent Direct.	303
June 6.....	409	32	34	41	25	32		573
„ 20.....	319	52	63	68	46	87	48	683
July 4.....	87	40	52	39	41	17	257	533
„ 18.....	51	23	25	23	25	15	178	340
August 1.....	21	15	25	29	11	3	79	183
„ 15.....	28	15	27	43	9	11	43	176
„ 29.....	22	11	7	14	5	4	54	117
September 12.....	16	14	11	35	2	10	59	147
„ 26.....	9	4	19	29	3	35	73	172
	2,107	346	353	377	173	214	791	4,361

N.B.—The great reduction in the number of cases admitted at the Eastern Hospital in the fortnight ending June 20th, and subsequently, was due to the fact that at and after that date cases were sent direct to the Hospital Ships from their own homes. The majority of such cases were sent from the districts which previously had been the feeders of the Eastern Hospital.

TABLE C.—Shewing the Parishes and Unions from which Acute Cases of Small-Pox were admitted at the Eastern Hospital, (at Homerton, in Hackney Parish), in successive fortnightly periods—November, 1883, to September, 1884.

Unions and Single Parishes.		Nov. 9	Nov. 23	Dec. 7	Dec. 21	Jan. 4	Jan. 18	Feb. 1	Feb. 15	Feb. 29	Mar. 14	Mar. 28	Apl. 11	Apl. 25	May 9	May 23	June 6	June 20	July 4	July 18	Aug. 1	Aug. 15	Aug. 29	Sep. 12	Sep. 26	Total.
Western District.	Kensington	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Fulham	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Paddington	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	1	3	1	...	...	...	...	...	...	7
	Chelsea	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	St. George's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
	Westminster	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
Northern District.	St. Marylebone	...	1	...	...	...	...	...	...	...	...	...	1	...	2	1	...	...	1	...	...	1	...	...	...	7
	St. Pancras	...	...	...	...	...	...	...	...	1	3	...	2	1	6	...	...	1	...	1	...	1	...	...	...	16
	Hampstead	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Islington	...	1	1	3	...	..	2	4	5	9	11	18	17	14	6	5	6	6	5	2	4	4	2	3	128
	Hackney	...	15	15	22	11	20	12	3	21	13	81	45	40	103	76	179	132	17	10	9	7	13	4	5	853
Central District.	St. Giles	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	1	..	1	...	...	...	...	...	...	2
	Strand	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	2	...	...	...	...	1	...	...	4
	Holborn	1	1	3	...	...	...	3	1	1	1	6	3	4	9	3	24	18	8	4	1	2	1	2	...	96
	London, City of	...	1	...	...	...	...	1	...	...	1	1	1	1	2	3	3	2	4	1	...	...	...	1	...	22
Eastern District.	Shoreditch	...	1	...	...	...	...	2	5	1	7	14	13	10	35	30	29	38	8	4	4	7	1	3	1	213
	Bethnal Green	...	3	4	5	2	4	12	2	6	4	16	7	34	48	39	75	82	21	19	2	3	1	...	...	389
	Whitechapel	...	1	...	1	...	...	1	...	...	...	2	3	3	9	8	10	4	4	2	...	1	...	2	...	51
	St. George's	...	2	2	...	...	...	...	...	...	...	1	3	1	12	15	16	6	4	1	...	...	...	...	...	63
	Stepney	1	3	2	1	...	3	1	1	2	...	2	4	6	7	12	13	8	5	...	1	...	...	...	...	72
	Mile End	...	...	1	...	...	...	...	2	3	...	...	...	5	26	24	37	11	6	4	2	1	...	...	...	122
	Poplar	1	1	...	1	..	...	1	5	4	6	2	2	1	8	2	16	5	...	...	...	1	1	2	...	59
Southern District.	St. Saviour's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
	St. Olave's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lambeth	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...
	Wandsworth	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Camberwell	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Greenwich	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Woolwich	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lewisham	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cases *admitted*		3	30	28	33	13	27	35	23	44	44	136	102	123	285	219	409	319	87	51	21	28	22	16	9	2,107
Cases *remaining*		30	46	60	66	61	69	83	42	34	23	44	54	43	47	49	36	43	33	20	17	26	21	20	14	

TABLE D.—Shewing the Parishes and Unions from which Acute Cases of Small-pox were admitted at the South-Western Hospital (at Stockwell, in Lambeth Parish), in successive fortnightly periods—November, 1883, to September, 1884.

	Unions and Single Parishes.	Nov. 9	Nov 23	Dec. 7	Dec. 21	Jan. 4	Jan. 18	Feb. 1	Feb. 15	Feb. 29	Mar. 14	Mar 28	Apl. 11	Apl. 25	May 9	May 23	June 6	June 20	July 4	July 18	Aug. 1	Aug. 15	Aug. 29	Sept 12	Sept 26	Total.
Western District.	Kensington	...	2	1	...	1	...	3	...	1	2	...	...	...	1	2	1	...	...	1	...	...	...	...	...	15
	Fulham	...	...	...	...	...	...	...	...	2	...	...	...	...	1	...	3	...	...	...	...	...	...	...	...	6
	Paddington	...	...	...	...	3	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	...	...	...	...	6
	Chelsea	...	...	...	...	...	...	...	...	...	...	...	...	...	6	2	...	1	...	...	...	...	...	..	...	9
	St. George's	1	...	1	1	...	...	1	...	1	1	1	...	2	7	...	1	1	4	3	...	...	...	...	1	26
	Westminster	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	5	1	...	...	...	...	...	10
Northern District.	St. Marylebone	...	...	...	...	...	2	...	...	...	1	...	1	2	...	...	...	...	...	...	...	...	...	...	...	6
	St. Pancras	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Hampstead	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Islington	...	...	...	3	1	...	...	1	...	...	7	4	1	..	...	...	...	...	...	...	...	...	...	...	17
	Hackney	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Central District.	St. Giles	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	3	3	2	1	2	6	8	...	28
	Strand	1	1	...	...	...	...	...	...	...	...	...	1	1	1	...	2	7	1	2	1	2	1	2	1	24
	Holborn	...	...	...	2	1	...	...	...	...	...	3	1	...	...	...	...	...	...	...	...	...	...	...	...	1
	London, City of	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7
Eastern District.	Shoreditch	...	...	...	...	...	...	...	...	...	...	3	1	...	...	...	...	...	...	...	...	...	...	...	...	4
	Bethnal Green	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Whitechapel	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
	St. George's	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Stepney	...	...	..	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Mile End	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
	Poplar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Southern District.	St. Saviour's	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	1
	St. Olave's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lambeth	...	...	1	...	3	1	1	...	...	...	...	...	2	10	4	18	27	21	9	6	9	3	3	1	119
	Wandsworth	...	...	4	...	...	1	...	...	1	...	...	...	...	6	1	4	11	6	4	7	2	1	1	1	50
	Camberwell	...	...	...	1	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Greenwich	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Woolwich	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lewisham	...	...	1	3	2	...	...	...	...	...	...	...	...	...	...	...	1	...	..	...	...	...	...	...	7
Cases *admitted*		2	3	9	11	17	6	5	1	5	4	14	8	9	37	9	32	52	40	23	15	15	11	14	4	346
Cases *remaining*		5	3	11	20	36	36	25	19	13	12	21	23	16	41	27	34	32	23	25	20	11	12	14	11	

TABLE E.—Shewing the Parishes and Unions from which Acute Cases of Small-Pox were admitted at the South-Eastern Hospital (at Deptford, in the Greenwich Union), in successive fortnightly periods—January to September, 1884.

Unions and Single Parishes.		Nov 9	Nov 23	Dec 7	Dec 21	Jan 4	Jan 18	Feb 1	Feb 15	Feb 29	Mar 14	Mar 28	Apl 11	Apl 25	May 9	May 23	June 6	June 20	July 4	July 18	Aug 1	Aug 15	Aug 29	Sep 12	Sep 26	Total
Western District.	Kensington	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Fulham	...	..	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...
	Paddington	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Chelsea	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	St. George's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Westminster	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Northern District.	St. Marylebone	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...
	St. Pancras	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	1	1	1
	Hampstead	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Islington	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Hackney	...	...	...	...	..	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	8
Central District.	St. Giles	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2
	Strand	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	1	..	..	...	...	...	...	...	1
	Holborn	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	..	...	1
	London, City of	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Eastern District.	Shoreditch	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Bethnal Green	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Whitechapel	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	St. George's	...	...	..	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	..	...	...	...	...	1
	Stepney	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
	Mile End	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Poplar	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Southern District.	St. Saviour's	...	...	...	...	...	...	...	...	...	1	...	2	1	4	12	11	15	5	6	5	4	...	1	...	67
	St. Olave's	..	...	...	...	...	...	...	...	1	...	1	...	7	5	5	4	12	14	11	3	4	...	1	1	69
	Lambeth	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	..	4	...	...	...	...	...	...	...	4
	Wandsworth	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
	Camberwell	...	...	...	...	...	...	...	...	1	1	...	..	2	4	3	12	23	14	6	10	7	2	2	5	92
	Greenwich	...	...	...	...	...	...	5	6	...	1	...	1	1	3	3	7	5	15	2	7	8	4	6	10	84
	Woolwich	...	...	...	...	...	...	...	..	1	1	...	...	1	1	...	...	...	1	...	...	2	...	...	...	7
	Lewisham	...	..	...	...	...	..	...	...	...	...	..	...	...	1	2	...	...	3	..	...	2	1	1	2	12
Cases *admitted* ...		...	...	...	...	...	...	5	7	3	4	13	3	12	18	25	34	63	52	25	25	27	7	11	19	353
Cases *remaining*...		...	...	...	...	...	...	6	12	12	13	25	12	22	27	27	32	32	39	29	29	26	12	10	12	

TABLE F.—Shewing the Parishes and Unions from which Acute Cases of Small-Pox were admitted at the North-Western Hospital (in Hampstead Parish), in successive fortnightly periods—May to September, 1884.

	Unions & Single Parishes.	1883 Nov. 9	Nov. 23	Dec. 7	Dec. 21	1884 Jan. 4	Jan. 18	Feb. 1	Feb. 15	Feb. 29	Mar. 14	Mar. 28	Apl. 11	Apl. 25	May 9	May 23	June 6	June 20	July 4	July 18	Aug. 1	Aug. 15	Aug. 29	Sep. 12	Sep. 26	Total
Western District.	Kensington	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	...	...	...	...	...	...	...	5
	Fulham	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Paddington	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	5	8	8	3	...	...	...	...	...	26
	Chelsea	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
	St. George's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Westminster	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Northern District.	St. Marylebone	...	...	...	...	...	...	...	...	...	...	...	...	...	1	6	13	13	8	6	11	3	...	2	3	66
	St. Pancras	...	...	...	...	...	...	...	...	...	...	...	...	...	1	12	7	11	8	6	5	20	9	10	8	97
	Hampstead	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	15	5	3	6	7	3	8	6	59
	Islington	...	...	...	...	...	...	...	...	...	...	...	...	...	4	18	9	16	8	5	7	13	2	15	12	109
	Hackney	...	...	...	...	...	.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Central District	St. Giles	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	1	...	...	...	...	...	...	1
	Strand	..	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...
	Holborn	...	...	...	...	...	...	...	...	...	...	...	...	...	5	7	1	...	...	...	...	...	...	...	...	13
	London, City of	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...
Cases *admitted*		...	...	...	...	...	...	...	...	...	...	...	...	...	12	44	41	68	39	23	29	43	14	35	29	377
Cases *remaining*		..	...	...	...	...	...	...	...	...	...	...	...	..	11	31	25	18	23	11	8	5	8	18	15	

TABLE G.—Shewing the Parishes and Unions from which Acute Cases of Small-Pox were admitted at the Western Hospital (in Fulham Parish), in successive fortnightly periods—May to September, 1884.

	Unions & Single Parishes.	1883 Nov. 9	Nov. 23	Dec. 7	Dec. 21	1884 Jan. 4	Jan. 18	Feb. 1	Feb. 15	Feb. 29	Mar. 14	Mar. 28	Apr. 11	Apr. 25	May 9	May 23	Jun. 6	Jun. 20	July 4	July 18	Aug. 1	Aug. 15	Aug. 29	Sept 12	Sept 26	Total
Western District.	Kensington ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	16	22	17	6	2	2	2	1	1	71
	Fulham ...	...	...	.	...	...	...	...	...	...	...	...	...	...	...	...	2	11	18	11	5	3	...	...	1	51
	Paddington ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	1	2	2	1	1	10
	Chelsea ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	9	4	4	1	2	1	...	...	25
	St. George's ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	3	3	...	2	...	...	...	...	...	11
	Westminster ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Northern District.	St. Marylebone ...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1
	St. Pancras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Hampstead ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Islington ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Hackney ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Central District.	St. Giles ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	2
	Strand... ...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...
	Holborn ...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	London, City of	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cases *admitted* ...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	25	46	41*	25	11*	9	5	2	3	173
Cases *remaining* ...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	28	29	31	22	16	13	3	2	3	

* Includes 1 case from Wandsworth and Clapham.

TABLE H.—Shewing the Parishes and Unions from which Acute Cases of Small-pox were admitted at the Plaistow Hospital, at West Ham (outside the Metropolitan Boundary), in successive fortnightly periods—May to September, 1884.

Unions and Single Parishes.		1883 Nov. 9	Nov. 23	Dec. 7	Dec. 21	1884 Jan. 4	Jan. 18	Feb. 1	Feb. 15	Feb. 29	Mch. 14	Mch 28	Apl. 11	Apl. 25	May 9	May 23.	Jun. 6	Jun. 20	July 4	July 18	Aug. 1	Aug. 15	Aug. 29	Sep. 12	Sep. 26	Total.
Northern District.	St. Marylebone	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	.	...	...	...	...	...
	St. Pancras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Hampstead ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Islington ...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...
	Hackney ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	..	...	...	...	11	12
Central District.	St. Giles ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	..	...
	Strand... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Holborn ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	..	...	...	...	2	2
	London, City of	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Eastern District.	Shoreditch ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...		...	3	4
	Bethnal Green	...	...	...	...	...	...	...	...	...	...	...	..	...	..	...	...	...	...	...	...	...	...	...	8	8
	Whitechapel ...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	4	15	3	4	1	1	...	...	2	30
	St. George's ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13	21	2	2	...	3	...	...	1	42
	Stepney ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8	5	3	2	...	...	...	..	...	18
	Mile End ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	32	5	5	2	4	...	1	2	55
	Poplar... ...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	1	14	4	2	...	3	4	9	6	43
Cases *admitted* ...		...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	32	87	17	15	3	11	4	10	35	214
Cases *remaining* ...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	32	11	11	24	11	13	6	12	28	

TABLE I.—Shewing the Parishes and Unions from which Acute Cases of Small-pox were admitted at the Six London Hospitals, in successive fortnightly periods, being a Summary of Tables C, D, E, F, G, and H—Nov., 1883, to Sept., 1884.

	Unions and Single Parishes.	Nov. 9	Nov. 23	Dec. 7	Dec. 21	Jan. 4	Jan 18	Feb. 1	Feb. 15	Feb. 29	Mar. 14	Mar. 28	Apl. 11	Apl. 25	May 9	May 23	Jun. 6	Jun. 20	July 4	July 18	Aug. 1	Aug. 15	Aug. 29	Sep. 12	Sep. 26	Total
Western District.	Kensington	...	2	1	...	1	...	3	...	1	2	...	...	...	1	4	17	27	17	7	2	2	2	1	1	91
	Fulham	...	...	...	...	...	...	...	...	2	...	...	...	...	1	...	5	11	18	11	5	3	...	...	1	57
	Paddington	...	...	...	...	3	...	...	...	...	...	...	...	1	5	1	6	11	10	5	1	2	2	1	1	49
	Chelsea	..	...	...	...	...	...	...	...	...	...	..	...	..[illegible]	6	3	3	10	5	4	1	2	1	...	...	35
	St. George's	1	...	...	1	...	...	1	...	1	1	1	...	2	7	3	4	5	4	5	...	...	...	...	1	37
	Westminster	...	...	1	...	...	...	..	...	...	...	...	...	...	1	...	3	1	5	1	...	...	...	...	...	12
Northern District.	St. Marylebone	...	1	...	...	...	2	...	...	..	1	...	2	2	3	7	13	13	9	6	12	4	...	2	3	80
	St. Pancras	...	...	...	...	...	...	...	...	1	3	...	2	1	7	12	7	12	8	7	5	21	9	10	9	114
	Hampstead	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	6	15	5	3	6	7	3	8	6	60
	Islington	...	1	1	6	1	...	2	5	5	9	18	22	18	18	24	14	22	14	10	9	17	6	17	15	254
	Hackney	...	15	15	23	11	20	12	3	21	13	89	45	40	103	76	180	132	17	10	9	7	13	4	6	874
Central District.	St. Giles	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	2	6	5	2	1	2	6	8	...	35
	Strand	1	1	...	...	...	...	...	...	...	...	...	1	1	2	...	2	10	1	2	1	2	2	2	1	29
	Holborn	1	1	3	2	1	...	3	1	1	1	10	4	4	14	10	25	18	8	4	1	2	1	2	2	119
	London, City of	..	1	...	...	1	...	1	...	...	1	1	1	1	2	3	3	2	4	1	...	...	...	1	...	23
Eastern District.	Shoreditch	...	1	...	...	...	...	2	5	1	7	18	14	10	35	30	30	38	8	4	4	7	1	3	4	222
	Bethnal Green	...	3	4	5	2	4	12	2	6	4	16	7	34	48	39	75	82	21	19	2	3	1	...	8	397
	Whitechapel	...	1	...	1	3	...	1	...	...	...	2	3	3	9	8	14	19	7	6	1	2	...	2	2	84
	St. George's	...	2	3	...	...	...	...	...	...	...	2	3	1	12	15	29	27	6	3	...	3	...	...	1	107
	Stepney	1	3	2	1	1	3	1	1	2	...	2	4	6	7	12	21	13	8	2	1	...	...	...	...	91
	Mile End	...	...	1	...	...	...	...	2	3	..	1	...	5	26	24	41	43	11	10	4	5	...	1	2	179
	Poplar	1	1	...	1	...	...	1	6	4	6	2	2	1	8	2	17	19	4	2	...	4	5	11	6	103
Southern District.	St. Saviour's	...	...	...	...	...	1	...	...	...	1	...	2	1	4	12	11	15	6	6	5	4	...	1	...	69
	St. Olave's	...	...	...	...	...	...	...	...	1	...	1	...	7	5	5	4	12	14	11	3	4	...	1	1	69
	Lambeth	...	...	1	...	3	1	1	...	...	...	...	...	2	10	4	18	31	21	9	6	9	3	3	1	123
	Wandsworth	...	...	4	...	...	1	...	...	1	...	...	...	...	6	1	4	12	7	4	8	2	1	1	1	53
	Camberwell	...	...	...	1	...	...	...	...	1	1	...	...	2	4	3	12	23	14	6	10	7	2	2	5	93
	Greenwich	...	...	...	...	1	...	5	6	...	1	...	1	1	3	3	7	5	15	2	7	8	4	6	10	85
	Woolwich	...	...	...	...	...	...	...	...	1	1	...	...	1	1	...	...	...	1	...	...	2	...	...	...	7
	Lewisham	...	...	1	3	2	...	...	...	...	...	...	...	...	1	2	...	1	3	...	...	2	1	1	2	19
Admitted at																										
London Hospitals		5	33	37	44	30	33	45	31	52	52	163	113	144	352	303	573	635	276	162	104	133	63	88	99	3,570
Hospital Ships *direct*		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48	257	178	79	43	54	59	73	791
Total Admissions		5	33	37	44	30	33	45	31	52	52	163	113	144	352	303	573	683	533	340	183	176	117	147	172	4,361

TABLE J.—Shewing the Parishes and Unions from which Acute Cases of Small-pox were admitted direct from their own homes at the Hospital Ships, in successive fortnightly periods.*

	Unions and Single Parishes.	Aug. 1	Aug. 15	Aug. 29	Sep. 12	Sep. 26	Total.
Western District.	Kensington	1	1	...	...	3	5
	Fulham	...	...	...	...	...	...
	Paddington	...	...	1	...	...	1
	Chelsea	...	1	...	...	...	1
	St. George's	2	...	...	...	...	2
	Westminster	1	...	...	...	...	1
Northern District.	St. Marylebone	4	3	1	3	3	14
	St. Pancras	4	2	5	4	13	28
	Hampstead	2	1	4	6	3	16
	Islington	3	1	4	6	12	26
	Hackney	19	5	1	4	19	48
Central District.	St. Giles & George, Bloomsbury	1	2	2	1	...	6
	Strand	3	1	1	...	1	6
	Holborn	1	1	...	...	4	6
	London, City of	...	...	...	...	...	...
Eastern District.	Shoreditch	5	...	2	2	6	15
	Bethnal Green	2	6	1	2	4	15
	Whitechapel	1	1	2	2	1	7
	St. George's-in-the-East	2	1	...	...	4	7
	Stepney	1	2	4	...	2	9
	Mile End Old Town	1	...	2	1	3	7
	Poplar	4	7	5	16	17	49
Southern District.	St. Saviour's	2	...	3	2	6	13
	St. Olave's	...	1	4	...	...	5
	St. Lambeth	4	2	5	...	2	13
	Wandsworth and Clapham	2	1	...	2	...	5
	Camberwell	7	3	1	1	...	12
	Greenwich	2	1	3	1	...	7
	Woolwich	3	...	1	...	...	4
	Lewisham	...	...	...	3	1	4
	Beyond Metropolitan Area	2	...	2	3	4	11
	Totals	79	43	54	59	108	343*

* In six weeks (June 7th to July 18th) 483 cases were admitted "direct" from their own homes, but from which Parishes, &c., the returns do not show. Of the "admissions" in the fortnight ended September 26th, 35 were patients transferred from the "Atlas" to the "Castalia": it follows that 791 cases were admitted "direct" between June 7th and September 26th.

TABLE K.—Shewing the admissions of Small-Pox Patients at the several Hospitals for the quarter ended the 31st December, 1884, together with the Population at Census of 1881 of the several Parishes, Unions, &c.

	Parishes, Unions, &c.	Cases admitted	Totals.	Population, 1881.	
Western District.	Kensington	55		163,251	
	Fulham	35		114,839	
	Paddington	22		107,218	
	Chelsea	27		88,128	
	St. George's	37		149,748	
	Westminster	13		46,549	
			189		669,633
Northern District.	St. Marylebone	40		154,910	
	St. Pancras	182		236,258	
	Hampstead	56		45,452	
	Islington	154		282,865	
	Hackney	147		186,462	
			579		905,947
Central District.	St. Giles and St. George	37		45,382	
	Strand	13		33,582	
	Holborn	93		151,835	
	London, City of	22		57,439	
			165		282,238
Eastern District.	Shoreditch	138		126,591	
	Bethnal Green	165		126,961	
	Whitechapel	43		71,363	
	St. George's-in-the-East	94		47,157	
	Stepney	59		58,243	
	Mile End Old Town	129		105,613	
	Poplar	217		156,510	
			845		692,438
Southern District.	St. Saviour's	92		195,164	
	St. Olave's	34		134,632	
	Lambeth	72		253,699	
	Wandsworth and Clapham	31		210,434	
	Camberwell	58		186,593	
	Greenwich	89		131,233	
	Woolwich	30		80,845	
	Lewisham	2	408	73,337	
					1,265,937
			2,186		3,816,193

This Table, in the Annual Report, is marked L. Table K of the Report is unnecessary here.

Summary of replies to questions addressed by the Secretaries.

	1.	2.	3.	4.	5.
	1. *Is there a special incidence of small-pox, as in London, upon the area immediately around the hospital?*	2. *Can you state whether infection has been conveyed from the hospital by personal intercourse or through the air?*	3. *Are there any public institutions in the vicinity of the hospital? What was the distance from the latter?*	4. *Were the inmates re-vaccinated?*	5. *Did they contract small-pox?*
Dr. GORNALL (Warrington).	No.	Not in my experience.	Yes; the Warrington Workhouse, 40 yards distant.		No.
Mr. VACHER (Birkenhead).	No.	No evidence.	The Borough General Hospital is 138 feet from the Small-pox Hospital; St. Peter's School, 338 feet; the Government School of Art, 390 feet.	Not as a rule.	No.
Dr. HILL (Birmingham).	There were a large number of cases around the hospital in 1883-84; but they were not confined to this area, they were all over the town; there were comparatively few cases in the immediate neighbourhood of the hospital, and many which were nearest to it were known to have been produced by persons coming to work in that neighbourhood from the Black Country, where the disease was very prevalent.	There was some evidence of the spread of the disease in a few cases by personal intercourse, but I can find no proof that infection was spread through the air, and I am of opinion that it does not extend in this way, nor by the sewers.	Yes; the Workhouse, less than 100 yards away, and the Workhouse bakehouse only 15 yards off; the Lunatic Asylum, 516 yards, and the Gaol about the same distance. The Workhouse contains about 2,500; the Lunatic Asylum, 750; and the Gaol, 600 persons.	"The inmates were re-vaccinated more or less and sooner or later."	There were about 25 cases in the Workhouse during the epidemic, more than half of which could be definitely traced to the town generally. There were not more than two or three cases in the Asylum, and only about two in the Gaol; but these institutions are in constant personal communication with the outside world.
Dr. DAVIES (Bristol).	No; even with 22 patients in the hospital.	By personal intercourse; but never by the air.	No; but there is a factory abutting on the grounds.		See answer to question 2.

SEWER VENTILATION AND HOUSE SANITATION.

By WILLIAM WEAVER, A.M.I.C.E., F.S.I.,
Surveyor to the Vestry of Kensington.

(Read: February 20th, 1885.)

The object of this paper is to invite attention to the general method of ventilating sewers: the increasing nuisance arising from such method of ventilation owing to the popular improved mode of house drainage; and to suggest remedies for the abolition or mitigation of such nuisance.

In order to properly comprehend the manner in which the present system of sewer ventilation and its attendant evils has arisen, it is advisable to consider the past history of sewers and the ventilation thereof.

Thirty years ago the sewers in existence, under the charge of the Commissioners of Sewers, were ventilated by the drains entering same, all of which had untrapped outlets. The drains were brick barrels, those from the numerous street gullies generally being of large diameter, and shooting direct into the sewers without any intervening trap. By these several means a free outlet was secured for the sewer gas, and whatever the volume thereof, its general diffusion rendered it comparatively harmless.

Stoneware pipe drains, with flap-trap outlets, next came into fashion; and, as their adoption extended, the increased duty of ventilation consequently thrown upon the aforesaid untrapped gullies, produced complaints as to the smells arising therefrom, and, as the most easy way of remedying such complaints, the old gullies, to a large extent, have been trapped, and many rebuilt, with the result of still further confining the sewer gas.

The progress of sanitary science gradually developed sanitary experts, who differed somewhat as to the relative merits of certain special traps and details of construction, but united in opinion on the one point, that the first essential in a perfect drain is to make it impassable to sewer gas. Hundreds of drains have thus been constructed, and although in some few instances, where the drain ventilator has been carried up the front of the house, a subsidiary vent-

pipe from the drain between the interceptor and the sewer has been connected therewith, yet, in the great majority of instances, no such subsidiary provision is made; the result being confinement of sewer gas to a still further extent, with consequent increased escape from the sewer ventilators in road, with a corresponding augmentation in the number and urgency of the complaints as to the smells arising therefrom. In many cases the stench is very apparent, and retards the letting or sale of the adjacent premises. In some instances within knowledge, the death of persons has been clearly traced to the inhalation of the noxious fumes from such ventilators, and doubtless many other lives have been lost from the same cause, although the deaths have not been traced or attributed thereto.

To alleviate the evils arising from the pressure on the sewer ventilators, efforts of a varying description have been made from time to time by the Metropolitan Board of Works and various local authorities. Exhaustive reports have been presented to the first mentioned body by their able engineer; and the result of the experiments may be summarised in the conclusion arrived at by the Metropolitan Board, viz., that although in some instances a certain amount of good resulted from some of the experiments, in the immediate portion of sewer dealt with, the result did not justify the general adoption of any of the methods or appliances tried, and the Board recommended the constant flushing and cleansing of the sewers, in order, as far as possible, to prevent the generation of foul gases.

In Kensington the following, amongst other experiments, have been made :—

A considerable number of patent charcoal ventilators have been fixed, on the assumption that the foul gases would be deodorised in passing through cages of charcoal broken into small pieces. It was found, on experience, that this course was practically equivalent to closing the ventilators, for the charcoal, however frequently renewed, became useless so soon as saturated with moisture ; the first heavy rainfall, moreover, had the effect of clogging and stopping up with mud the meshes of the grating. The whole of these patent ventilators have been taken up and replaced with the ordinary open gratings.

With the same view of rendering innocuous the escaping gases, a further experiment was initiated and tried. This consisted of forming a chamber in the ventilating shaft, and fixing therein a frame from which was suspended numerous hanks of loose tow dipped in a

solution of carbolic acid. The result of the experiment was deemed satisfactory, but the attendant expense was too great to permit its general extension.

In some situations, ventilating pipes from sewers have been carried up the fronts or sides of houses; in a few cases flues, for the same purpose, have been provided in the walls of buildings; in other positions, such as the junction of several roads, pipes from sewers have been connected into the columns of refuge lamps. These several systems are good, so far as they go and as long as they continue to act, but, from their scarcity, the fringe of the subject is but touched.

Furnace shafts have also been suggested; and in one situation in Kensington the suggestion has been carried into effect, by connecting certain sewers into the furnace shaft of the Campden Hill Waterworks; but this, of course, is a most exceptional situation, as the shaft, some 200 feet in height, is built on the summit of a hill, and towers above the country for miles around.

In devising an entirely new scheme of sewerage for a town, a series of high shafts, with or without exhaust fans, could be effectually adopted; such a system, however, would be inapplicable to a network of old sewers of varying levels, with a large number of dead ends; but even granting the practicability of such a system of shafts, it is certain that the objections to their erection from the residents adjacent to the site, would effectually bar their construction, and would most likely result in the extension to such sewer shafts of the order passed by the Kensington Vestry relative to proposed public urinals, viz., that they should not be erected in antagonism to the expressed feeling of the abutting neighbourhood.

With regard to the general adoption of lamp-post ventilation, we cannot rightly assume that the flame would destroy the sewer gas; it might create an updraught, and there would be some risk of explosion, but the general effect would be similar to the before-mentioned untrapped gully system, with the slight difference that the sewer smells would be delivered at a somewhat higher level.

Another scheme of ventilation, suggested and tried on a small scale, is to carry up an exhaust ventilating pipe from the dead end of a sewer, trapping off the outlet end thereof, and only leaving open the one ventilator at the commencement to serve as a fresh-air inlet. Provided all the house and gully drains are trapped against the sewer, such means of ventilation to a sewer in any one street would probably prove efficient; but it is hardly necessary to point out that the trapped sewer outlets would require constant and regular atten-

tion, and the risk of floods, through the choking of such syphoned outlets, would be so great as to cause any engineer responsible for the drainage of a district to shrink from recommending their adoption.

The present general system of sewer ventilation, by means of open gratings in the road, next requires consideration. In connection with the old sewers formerly ventilated through the gullies and house drains, a number of ventilating shafts, with these open gratings in road, have been constructed, and in forming new sewers, such ventilating shafts are generally provided at intervals of 200 to 300 feet. It was usual some years back to construct the ventilators at longer intervals—from 500 to 600 feet—but, owing to the increased volume of gas in the sewers, it has been considered advisable to diminish the intervals, in order to secure a greater diffusion of the exhalations, and render them less objectionable. As might be expected, however, the increased frequency of the open grids has caused an increase in the number of complaints as to their existence and position, and presumed prejudicial effect. The complaints, generally, are more or less well founded, but in some cases the nuisance complained of has been entirely imaginary. An amusing instance occurred in South Kensington, where urgent complaint was made as to a particular ventilator ; on careful examination no smell could be detected. The complaint, however, was renewed with increasing vigour, and in response thereto the grating was closed up from the sewer below ; a third letter was, however, subsequently received, protesting still more strongly against the emanations from the *closed* grating.

Apart, however, from the *actual* nuisance arising from the open gratings, there is hardly any doubt that the *imaginary smells* have an effect on the public health. Moreover, the good sought to be achieved by the increase in the number of the gratings is discounted to some extent by the obstacles lodged in the flow of sewage, caused by the mud and stones passing through the gratings. In sewers with slight inclines such obstacles soon cause a deposit of solid matter generating sewer gas, and thus the open grate means of *diffusion* becomes, in a minor ratio, the cause of *generation* of gas.

Another inconvenience attendant on the gratings is the frequent backing up required, in order to adjust the variation of road level, consequent on wear and tear of surface.

The attention now given to sanitary science, compels the adoption of all improvements suggested by its study, and these improvements in the construction of house drains and their connected works and apparatus, doubtless confer *primary* benefits on the premises particu-

larly dealt with ; but it is very questionable whether the *secondary* crop of general evils, indirectly arising therefrom, does not outweigh the advantages apparently secured in the individual instances.

Sanitary science, in each house wherein its aid is invoked, seeks to make that particular house impervious to sewer gas ; but in so doing concentrates in a more condensed form the evil which theretofore was more diffused. As an example of the meaning sought to be conveyed, take an ordinary street containing, say, twenty houses, each draining separately into a 3 ft. by 2 ft. sewer under the road in front, and this sewer having an ordinary open grate ventilating shaft at each end. Each drain with flap-trap outlet would pass under a house without any intercepting trap, and having the soil pipe in direct communication with the drain ; in some cases the soil pipe would be carried up above the roof and serve as a ventilator, and in other cases a special pipe would be provided for the purpose of ventilation. In the twenty houses referred to, the drains, conjointly with the open gratings in road, would carry off the sewer gas and diffuse same in an innocuous form above the roof level; or, if perchance any smell should escape, through defects in one or more of the drains, it would not be of a deadly character likely to cause serious illness. Now suppose ten of the twenty householders resolve to make their houses sanitarily perfect ; each drain is made thoroughly sound and provided with an intercepting trap or chamber, making it impossible for any gas or stench to pass from the sewer through the drain under the house. The consequence of such drain improvements would be that the foul gases in sewer would be about doubled in density and pressure, and would escape through the road gratings in a more offensive form ; and any exhalation through the defects in the non-improved drains would probably prove of a deadly character, where before, owing to their greater dilution, their presence was hardly perceptible. In other words, in this particular street, under the first system of drainage, each resident had a chance of inhaling a non-poisonous dose, whilst under the second *improved* system a moiety of the residents pour their dose of the poison into the already charged cups of their neighbours, thus affording another example of the self-assertive power of superior wealth and intelligence.

It is contended that a system giving increased security to the few at the expense of the comfort and security of the many, is a false one and should not be maintained. To readily get rid of the nuisance from your own house and pass it on (you care not where) is personally

a comfortable doctrine, but at the same time it is a selfish one, and not worthy of good citizenship.

If it were a fact that the drainage from one house, so soon as joined in the public sewer by similar outflows from other houses, thereupon ceased to be a nuisance—then, and only in such case, could such plan of improved drainage be maintainable; but while the question of sewer ventilation is an unsolved problem, then such a system of perfecting the drainage of individual houses must be considered unsound and opposed to the general good.

In support of the theory of intercepted house drains it is contended that it is the duty of the public authorities to perfectly flush and provide efficient and inoffensive methods of ventilation in the public sewers, householders being required only to ventilate their house drains as distinct from the sewers. If the first part of this proposition could be carried into practical effect, nothing much could be said against the theory in its entirety; but inasmuch as such perfect flushing and inoffensive ventilation cannot practically be attained by any reasonable expenditure, it should not be permissible to perpetuate a system antagonistic to the general interests of the community, especially if a reasonable remedy can be found.

As an illustration of advanced domestic sanitation, assume the existence of a street wherein every house and gully drain is sealed against the passage of sewer gas. The law permits the formation of a street 40 feet in width, inclusive of side paths, and such street may be half a mile long, with an unbroken row of four-storied houses on each side accommodating about 3,000 persons. The excreta from all these houses are constantly being discharged into the sewer, there to flow away as fast as the incline permits; but some portion, more or less, according to rain and other flushing power, will deposit itself and generate gas, the only vents for which are the open gratings at intervals in the road surface.

In addition to the sewer smells, add the *aroma* arising from the dustbin to each house, placed most likely in the front area; and although, in a properly governed household, the contents of the dust-bin *should be* perfectly innocuous, and consist merely of fine ashes and dust, still, as a matter of fact, a modern *dust* bin is more like the old hog-wash tub than a receptacle for ashes. This arises from two causes: first, the growth of London, which has banished the pig keepers and wash boilers to the country or remote suburbs; and, secondly, the changes operating in social life, which have converted the *mistress of the household* into the *lady of the house*, without time

or taste for the superintendence of the concerns of the servants' basement.

Imagine, then, this modern sanitary street, with its combination of evil odours, on a calm, sultry, summer night, with open bedroom windows, and similar houses about ten feet distant at the back, and a truthful picture is drawn of the surroundings of many a well-to-do citizen, as he lies resting from the toils of the day, and refreshing himself for the duties of the morrow.

As before stated, it may be urged that it is the duty of the public authorities to keep the sewers perfectly clean, either by manual labour or by flushing, automatic or otherwise; but when it is considered that the first method, to be efficient, must be carried out without intermission, it will be apparent that the heavy expense of this description of laborious and repulsive underground work precludes its otherwise than intermittent adoption. At the present time, the brick sewers are cleaned out every three to nine months, according to the rate of deposit. If this cleansing process was performed three or four times more frequently, still, between the visits of the sewer men, deposit would be formed, and, therefore, the increased labour and expense would be but a slight safeguard.

With regard to the second method of water flushing, the expense is a fatal objection against it. No district would suffer the increased rating burden. To discharge into the sewers of Kensington a body of water equal to an inch of rainfall throughout the parish would cost £1,500 for each such discharge, taking the water at the rate of 6½*d.* per 1,000 gallons. Apart from the question of cost, another difficulty is this, that during times of long-continued drought, when water flushing is most needed, the scarcity of the metropolitan water supply, often approaching a water famine, would render such system of water flushing dangerously unreliable, and very likely non-available when most urgently required.

The public authorities, without doubt, would be only too ready to adopt any reasonable means of dealing with the growing evils of the present system of drainage; and it appears to the writer that the simplest and most economical remedy is to make each house aid in the harmless diffusion of the effluvium which it helps to create. This could be done by requiring every house to carry up a ventilating pipe in direct connection with the sewer. If the drain is trapped against sewer gas, the said ventilating pipe should be carried up the front of the house. If not so trapped, the ventilating pipe should be carried up the rear of house. The latter mode is prefer-

able, and if the drain is laid in a proper manner, there is not the slightest danger of sewer gas escaping therefrom. The sinks, waste pipes, etc., should discharge over gully and grease traps, and the soil pipe should be trapped at its foot. In this position, a trap is much more likely to be kept free of deposit, owing to the greater force of the vertical flush of water, as contrasted with the horizontal dribble through a syphon fixed in the main drain. Flap traps at drain outlets should, as a rule, be abolished. If they are hung, so as to shut tight by reason of their weight, they impede the flow of the drain; if they are hung just on the balance, they will not close at all, owing to the gradual accumulation of grease, etc., at the outlet. The exclusion of rats from the drain is the chief purpose served by flap traps, whereas, in properly laid drains, from which, of course, they cannot escape into houses, rats are desirable scavengers. In the exceptional instances of periodically overcharged sewers, the flaps should be retained.

A further improvement in the general system of sewerage could be effected by making it compulsory to leave open spaces at regular intervals between blocks of buildings, and ventilating flues from the sewers could be carried up in, or on, the flank walls of the buildings abutting on such open spaces. The law relating to the submission for the approval of the Metropolitan Board of Works of all plans for forming new streets, would have to be amended, so as to include in such plans, as aforesaid, the blocks of proposed buildings.

Relative to the construction of drains, the law, as it now stands, vests in the District Boards and Vestries most absolute powers; to the effect that all drains and connected works shall be laid and executed in such manner and with such materials as the Board or Vestry may require, and to the satisfaction of their officers. Whatever objections the latter may have against intercepting chambers, etc., they know it is useless attempting to enforce such objections, inasmuch as the objectionable detail can be quietly inserted after the drain has been finished and passed.

It is somewhat unfortunate that there is no society uniting in membership the engineers and surveyors to the various local authorities throughout the metropolis; from such a society much practical experience might be elicited with a beneficial result, and there is good reason to believe that the bulk of such experience, if expressed, would be in harmony with the views set forth herein.

It is anticipated that sanitary experts will disagree, more or less, with the opinions herein advanced; but it must be borne in mind

that the theory of action in a sanitary expert is not the greatest good to the greatest number, but the greatest good to his particular clients. So long as the houses drained by the sanitary expert are few and far between, it is admitted that the greatest good results to the client, with but an infinitesimal amount of evil to the general public. On the other hand, if every house was "sanitarily experted" upon, and the sewers left as they now are, the writer would expect typhoid fever, or a plague of some description, to be rampant throughout the metropolis.

In conclusion, therefore, the following propositions are submitted for consideration :—

1. That sewers and drains should be dealt with together as one system, the former depending upon the latter for ventilation, and the latter on the former for outlet. The open gratings in roads could then be abolished, except where left at intervals to serve as fresh-air inlets. The ventilating pipes should be kept as far as possible from windows and flues, and be governed by the same rules that apply to the latter when adjoining premises are increased in height. This proposed arrangement to apply to all new drains to be constructed after a certain date.

2. That spaces or gaps should be left at regular intervals in lines or rows of buildings, in order to promote circulation of air and admit of the construction of sewer ventilating flues.

3. That dust bins should be abolished, and in lieu thereof, each house should provide a galvanized iron or other approved receptacle for the dust and ashes ; such receptacle to be left in a certain position on an appointed day in each week for regular removal by the local authority. No vegetable or other burnable refuse to be placed in the said receptacle under penalty.

4. That the Metropolitan Board of Works, District Boards, and Vestries should be urged to co-operate, in order to obtain powers to the effect set forth in the three preceding propositions.

Discussion.

The President said the Society were extremely pleased to have heard the instructive and practical paper by Mr. Weaver, who had devoted a great amount of time and attention to the subject, every new drain laid in Kensington, for several years, having been inspected in the course of the work by officers, under his direction. With regard to the charcoal ventilators, Sir Lyon Playfair thought

very highly of them, and had urged him to use them where there were bad smells. As to lamp-post ventilation, that had not been a great success. In one town he knew it had been in practice, but had been done away with. There was an objection to it because the smells entered the windows. One of the four propositions in Mr. Weaver's paper was that the Metropolitan Board of Works and the Vestries and District Boards should co-operate to obtain certain powers. He thought the powers already existed, and only required to be put into operation. In support of this view he quoted from his paper on Metropolitan Sanitary Adminstration, read in October last, as follows :—"The Metropolitan Board *may* make by-laws for regulating the dimensions, form, and mode of construction, and the keeping, cleansing, and repairing of the pipes, drains, and other means of communicating with sewers, and the traps and apparatus connected therewith ; for the emptying, cleansing and closing, and filling up cesspools, and of removing and disposing of refuse. Section 138* provides that the Board *shall*, in order to secure the efficient maintenance of the main and general sewerage of the metropolis, make such general or special order as to them may seem proper for the guidance, direction, and control of the vestries of parishes and district boards in the levels, construction, alteration and maintenance, and cleansing of sewers in their respective parishes or districts, and for securing the proper connection and intercommunication of the sewers of the several parishes and districts, and their communication with the main sewers vested in the said Metropolitan Board, and generally for the guidance, direction, and control of the vestries and district boards in the exercise of their powers in relation to sewerage ; and all such orders shall be binding upon such vestries and boards. Theoretically, what more, what better could be desired? Said I not rightly that pretty well the whole field of sanitary administration was covered by the existing powers? Section 73 enables the vestry, as the local authority, to require owners, etc., of houses to construct drains therefrom into the common sewer, not at their own discretion, but subject to conditions, which, among other things, provide for fit and proper sinks, and fit and proper syphoned or otherwise trapped inlets and outlets for hindering stench therefrom, fit and proper water supply . . . . and all other such fit and proper works and arrangements as may appear to the vestry or board, or to their officers, requisite to secure the safe and proper working of the drain. It seems reasonable to conclude that this

* Metropolitan Management Act.

section should be read with section 202, and that the vestry should be guided, directed, and controlled in the exercise of its powers by by-laws formed for the purpose by the board. But there are no such by-laws. And so with regard to sewerage. No definite principles appear to have been laid down for the guidance of local authorities. Hence it follows, to cite a single illustration, that one local authority is continually passing plans for pipe sewers, which obtain the sanction of the board, while in the next parish, it may be, a pipe sewer is an almost unheard of thing, brick-barrel sewers only are acceptable, and they are equally sanctioned by the board. Comment on such a state of affairs is needless." Looking at the powers which they had at present, he thought they had no right to ask for more legislation until they had exhausted the powers they had. Experts should not be allowed to step in and alter existing sanitary arrangements at will; there should be no interference with a drain unless with the consent of the local authority. As to intercepting chambers, if a householder did protect himself by that means, he ought to ventilate the chamber, so that he could not do an injury to others, as Mr. Weaver contended he now did.

Mr. ROBINS said that, with regard to the ventilation of the main sewer through the houses, he recollected, as far back as 1853, sending a proposal to a local board on the subject. One of the members made a design for forming pillars in the roads, something like our pillar-boxes. These were fitted with shelves, and the air passed over these shelves and came out perfectly innocuous. He had thought a good way of ventilating the drains was by means of the rain water pipes, but he had had to abandon that method.

Mr. TURNER said that, although having no practical experience of the ventilation of sewers, he had given considerable attention to sanitary construction. He thought they should approach the subject as students, and not as authorities upon it. He thought they should first see whether Mr. Weaver's premises were correct. As far as his (Mr. Turner's) experience went, the number of intercepting chambers in London must be very few. Mr. Weaver had said that thirty years ago all the drains had untrapped outlets, but that, he thought, required a little explanation. At the same time there were very few ventilating pipes. It was also stated that the death of persons has been clearly traced from the effects of sewer gas. That might be so, but perhaps the medical officers would tell them. The Metropolitan Board had recommended "the constant flushing and cleansing of the sewers, in order to prevent the generation of foul gases"; but

Mr. Weaver proposed to throw aside that recommendation, although arrived at after great consideration, and he said it was practically impossible. He (Mr. Turner) thought that surveyors should direct their attention to proper flushing, which, it appeared to him, was in its infancy. Mr. Weaver had said that water was 6½*d.* per 1,000 gallons, but they did not want drinking-water for flushing sewers—he only gave that as a suggestion. As to charcoal filters, they were tried at Croydon and other places, and they failed. Then there was the experiment of having numerous hanks of tow dipped in a solution of carbolic acid, but the expense was too great. Intercepting chambers were objected to by many, but the only cases where they were not satisfactory were when they were not properly constructed. He had seen many very improperly constructed, and they became nothing more than cesspools.

Mr. BUTTERFIELD looked at the question as a medical officer. Endless complaints were made of the surface ventilation. He found them very frequent in the Urban Sanitary District of Beckenham and at Chislehurst. He came to the meeting to be guided on a particular point, viz., whether surface ventilation should be abolished altogether, or whether the number of ventilators should be increased? He would like to hear some opinions on that point, because it had been urged upon him that disease had been propagated by surface ventilation—diphtheria and enteric fever—and, although he had not traced any direct connection between such ventilation and zymotic disease, he had not the slightest doubt of the complaints being well founded. There might be a deficiency of water. In some sewers it had been the object of sanitary authorities to keep as much water as they could, but some had taken every means to prevent the rain water from entering the sewers. In Bradford, where he resided for ten years, they had no complaints from surface ventilation, and the reason for that might be the number of dye-works and other manufactories, from which there was a constant flow of water. He quite agreed that water should be supplied for the carriage of sewage, other than filtered water.

Mr. SOUTHAM, said that, while agreeing to a considerable extent with Mr. Weaver, he could not go so far as he did in making it compulsory upon owners of houses to ventilate the sewers. House owners were taking care of themselves, and were tending to complain at once of any slight smell; and this had been more frequently the case since the Health Exhibition. If they were asked to allow a ventilating pipe to be taken up the house, they

would suggest that it should be done on the other side of the way. They had done a great deal in Clapham. Where there was a dead end they had put ventilators against the houses three feet above the roof. They had also increased the number of road openings with advantage. They had, in Clapham, some difficulty with a new sewer. On a new estate the owners submitted a plan for sewers. As soon as the houses were built there were complaints. There was, however, a stipulation that the owner should provide ventilation, and the Metropolitan Board have power to withhold their consent until that is done. There should be ventilators not less than six inches in diameter. With regard to flushing, there was generally sufficient water in streams. There was a stream in his district, and he flushed regularly by means of a shaft, which, when full of water, was opened, and the water allowed to escape in a volume. As to dust-bins, he thought there should be two services for the removal of the dust. The present system was, of course, open to great objections, and it is thought that all refuse should be carried out of London; but if the ashes could be saved they would be of great value.

Mr. MINEARD spoke of the deposit of particles of sand and gravel, etc., in the sewers, which ought to be prevented. He could not agree with some of Mr. Weaver's suggestions. He had managed to ventilate his own house, and he also ventilated the sewer, by carrying the ventilator up his house. He thought this was a desirable thing, if it could be agreed upon, and the more compulsory it was the better. Many people would be glad to do it, but others, probably, would not be willing. A three or four inch pipe was a sufficient size—a six inch pipe was too large. The trap was the weak point in every drain, but a flushing cistern compensated for that. He thought the flushing cistern of Mr. Rogers Field was the best, it was in action at the top of his house, and he had also an extra flushing cistern with rain-water. The discharge pipe was $3\frac{1}{2}$ inches in diameter and the fall six or seven feet, and this would fill an ordinary house drain, and effectively keep it clear. This could be done without much extra water. He objected to sewer gas being sent under the house, the sooner it was allowed to escape the better. For many reasons he would prefer that the ventilating pipes should be in front rather than at the back of the house. Unless sanitary authorities agreed upon what was desirable, it would not do to make anything compulsory. For instance, there was the pan-closet. Sanitary engineers were making them to-day. Surely that might be stopped. It was said of

flushing cisterns that they were very expensive, but they were worth all the money they cost. He quite agreed with Dr. Dudfield that, if a drainage were carried out to the satisfaction of the local authority, it ought not to be interfered with without their consent.

Dr. ALFRED CARPENTER said he had been very much pleased to find that Mr. Weaver had come to very sound conclusions with regard to the course to be adopted on this question. Twenty years previously he advocated similar opinions in a paper which he read in that room. Whatever tended to oppose the flow of sewage downwards or the current of air upwards was not a proper system. They ought to adopt what might be called an ideal principle; and if they had a perfect system of sewerage they would have no sewer-gas, and therefore no nuisance. Complaints were getting more and more serious, and they arose from two causes. There was great imperfection of work. The sewers ought to be properly laid and properly flushed regularly. If the soil pipe were continued with the same diameter to the top of the house, all the injury would be dissipated in the atmosphere, and it would do no more harm in the atmosphere than carbonic acid gas, and would soon be rendered innocuous. It would have this effect, too, that the openings which exist in the streets would become inlets for air instead of outlets. Eighteen years ago, when this subject was engaging attention, Mr. Baldwin Lathom introduced charcoal ventilators in the sewers where complaints were made, and after a time he gave his adhesion to their introduction, but he found afterwards that at least one-third of them became openings for air—inlets for air instead of outlets—and that they became coated with dust and dirt. The action of air in that particular sewer would be sufficient to keep it free from smell, provided the inlets corresponded in number with the outlets, as they should do. It was a great mistake to close inlets because they were smelling. The right course would be for the sewer to be examined and flushed, and more room made, instead of shutting it up. He knew a case of typhoid fever in Park Lane pretty clearly traced to a closed ventilator. It was not a deposit on the floor of the sewer only which tended to produce sewer-gas, for unless the sewer were thoroughly flushed up to the invert of the arch, the vegetable growth was always going on, and this was so to a very great extent in the impervious sewers—in others it would not be so bad—and it was for this reason that he thought that sewers ought not to be too large. There was a tendency to look upon the main sewer as an evil, and by doing this people were preventing necessary ventilation.

Every person who built a house should continue the soil-pipe to the main sewer without the intervention of intercepting traps. He was not in favour of the suggestion of Mr. Butterfield, that the ground or surface water should go into the sewers. If the sewers were kept for sewage entirely, under proper arrangements, there would be no necessity for the surface water, and the sewers would flush themselves in the ordinary way. There ought to be a discharge every 24 hours, so as to have the invert flushed as well as the base.

Mr. ARMSTRONG was of opinion that sewer-gas should not be allowed to enter into the houses. As to burning all the rubbish, he thought it was a great waste to destroy organic matter, for it could be used as manure, and it was a waste also to let all the sewage go into the sea.

Mr. MARK JUDGE proceeded to review the management of sewers and drainage by the local authorities. These bodies appointed sanitary inspectors who needed not to pass any examination to obtain their appointments. But what salaries did they get? The local authorities were weak, and could not control the sanitary arrangements of houses, and they had no support from the public. He knew of instances where the builders had over-ridden the decisions of the authorities in the matter of drainage. His experience showed him that what was wanted was increased compulsory powers, and that the local authorities should do their duty and uphold their decisions. The local authorities should do the works, and not private individuals, and any proposal to take pipe sewers through private houses should be opposed to the utmost.

Dr. BATE said he had examined a total of 182 drains in his district upon complaints made, and he found 112 were clear and 50 choked. There were 162 ventilators, and in 82 per cent. there was an up-current. In 49 cases the smell was offensive. In the main roads there was very little stench, but in the side streets it was bad. He objected to the ventilating pipe going into the house, it should be in front; but in the present state of things every man must do the best for himself. He had the advantage of having the means in his district of letting in the river water and flushing the sewers properly. A sewer 1,000 feet in length had lately been built, and they had had no difficulty in getting the consent of owners to put up pipes connecting with the sewers direct, and that had been a success. There should be, he thought, a multiplication of gratings in the streets, and more flushing; the sewer should be small enough to be thoroughly flushed, and large enough for a man to go through.

Dead ends were a source of great danger, and they should be connected. He had found the greatest possible benefit from ventilating through rain-water pipes taken up the front of the houses.

Thursday, March 5th, 1885.—Discussion continued.

Mr. F. M. CORNER, in continuing the discussion, said he hoped the surveyor of Poplar (Mr. Parker) would have been present to give his experience, but he had been unable to attend. Mr. Parker, in order that no serious emanations should be experienced, hit upon a scheme of a self-acting shaft that should always be in operation, and his returns were rather startling.

Experiment with Parker's Down-Current Shaft.—The distance from cowl to end of 9-inch drain in sewer was 132 feet.

Dates.	Temperature out of Sewer.	Temperature in the Sewer.	Velocity of Wind out of Sewer in Miles per Hour.	Velocity of Wind at end of 9-inch Drain in the Sewer in Miles per Hour.	Cubic feet of Wind forced into the Sewer per Hour.
1876.	Deg.	Deg.			
Nov. 23	40	50	3.59	1.20	2787
,, 24	44	50	2.58	1.46	3411
,, 30	48	50	4.48	2.00	4640
Dec. 4	52	50	7.18	3.59	8361
,, 7	48	50	3.98	1.50	3483
1877.					
Feb. 21	36	46	5.98	1.64	3832
Mar. 7	35	46	4.50	1.27	2961

He (Mr. Corner) was entirely at one with Mr. Weaver if the sewers could not be properly ventilated. He supposed the Metropolitan Board had gone into everything and had failed. If that were so, it was for the local authorities to come to their rescue. He thought Mr. Weaver's suggestions were practical, and easily adapted to the present state of things. If they could only experiment successfully in one street, there would not be great difficulty in taking the improvements into other streets. He thought it would be an easy matter to fix one of the exhaust cowls. He had a syphon trap, which had saved him from the main sewer, but in consequence of its being taken away for repair, he soon began to suffer from the gas from the main sewer. He was now disconnected from the main sewer by a Doulton's trap, and having one of Parker's down shafts

on the house side of the trap, he had a powerful current of air passing along the house drains. In Poplar they not only had to deal with ordinary sewage, but with the products of manufactories, and the Metropolitan Board's officers had to go there and actually dig out the refuse from the sewers. A great difficulty was that the Metropolitan sewers were liable to be overcharged. In the East of London the sewers were full, or nearly full, and the overflow sometimes extended into the house drains. A further difficulty was that the Metropolitan Board had been closing a large number of the openings in consequence of complaints of smells. He did not think it would be fair to expect individual householders to do away with their disconnecting traps or chambers now, but Mr. Weaver's plan might be tried as an experiment in a certain street of say 50 houses.

Professor CORFIELD disagreed with nearly everything in Mr. Weaver's paper. Almost the only thing he agreed to was the remarks about charcoal ventilators. He took it that the paper was entirely against disconnecting the drains from the sewers. He did not think there was anybody there who would say that the householder should be made to have his drains aerially connected with the main sewer, for it was quite certain that in a pipe sewer at many times there were poisons of certain specific diseases which discharge into the drains. A water trap that could be properly flushed would prevent the poison coming from the street if the sewer were ventilated at all. He disagreed with the soil-pipe being trapped at its foot, as it is always full of foul air, in the same way as a rain-water pipe is when trapped. The soil pipe should be open at both ends. If mud and stones were allowed to get into the sewer, it was not properly constructed.

Mr. NIDD SMITH said that, in discussing the subject of Mr. Weaver's paper, he should say that he had several times visited the whole of the main and many of the local sewers on the south side of the Thames river, so that he knew what their general condition is, as to silty deposits, entries (or outlets of local sewers), sewer-gas, etc., etc. The means used by himself to remove silty deposits from about 85 miles of brick and pipe sewer inverts, as a great preventive of gaseous formations, are entries, manholes, not more than 200 feet apart, windlasses to work hinged hoes, wire brushes, sewer trucks, bamboo jointed rods, and water. Water should be laid on to sewers at uniform distances; it is of more vital importance, in a sanitary point of view, than watering the surface of roads. The sewers and gullies on the south side of the Thames are not sufficiently cast and cleansed,

which is the principal cause of the very foul odours arising therefrom. The number of flushers employed should be regulated by the size and mileage of the sewers in each district, and be determined by Act of Parliament, so as to be imperative on all sanitary authorities. All metropolitan main sewers should be ventilated by the use of high shafts and fires, because there is no other means of effectually accomplishing that object in a sanitary manner, for the following reasons: first, the soffits or summits of the sewers form stupendous gas chambers, which store the concentrated gas from all the sewers in this vast metropolis and in the valley of the Thames; secondly, all local sewer outlets enter the main sewer-line at about the springings of those mains and below the chamber referred to; and thirdly, to disseminate the concentrated sulliage gas of the metropolis all over such metropolis would be anything but a sanitary procedure. The shafts mentioned should be trapped with a Day's windguard, so as to diffuse the gas when it makes its exit, as fire cannot always be kept in a homogeneous state. Fourthly, the use of high shafts and fires would minimise the number of shafts required. All local sewers should be ventilated by ornamental shafts, metal or otherwise, according to circumstances, and not less than 50 feet in height, generally speaking, also capped with a Day's windguard. These shafts would not, in many cases, require fire to consume the gas, for the following reasons: first, the outlets of all local sewers should be provided with metallic flaps to prevent gas from the great store chambers referred to from rising in such sewers; secondly, the 40 gallons of water per day from each house would absorb the daily formation of gas to a considerable extent, and carry it in the sulliage water past its outlet sealing flap into the main sewer; also, the diffusion of gas by the windguard, from the summit of shafts placed over each sewer in a district, would pass off into the atmosphere at a high point, and not be detrimental. All house drains should be ventilated from the summit of the soil-pipe trap, as long since recommended by Dr. Carpenter, and should not be less than one inch in diameter, of stout iron, and carried up from such trap at least four feet above the highest point of dwelling or building, and capped with a Day's windguard. He had experimented with this for a period of about 25 years, and tested the currents of gas by a dynamometer, and its quality by sensitive chemical paper, and he found that, under all circumstances, such as heavy rains and strong wind, rain and quiet atmosphere, fog and quiet atmosphere, at various times during the summer and winter months, although the warm

air in the sewer in the winter time, or the cold air in the same in the summer, favoured the ascent of sewer-gas in a shaft, he had never found a descending current, but always an upward one; of course there might be other windguards, but he had not yet been fortunate to find one so good. These tiny guards to house vent-pipes are very inexpensive, as also the vent-pipe itself, which prevents the traps in drains, where double-trapped, from becoming partly untrapped by the piston action of the water between the two traps. All the matters that he had referred to, the Government should insist upon being carried out, because they are practicable and beneficial, or they should enforce some better practical means, because they are of such immense importance to the general health and well-being, he might say, of the four millions of people who live in London, and the millions who live outside that great city. He thought the best course to be pursued would be to instruct a solicitor in the matter in question, and then for him to draw up a memorial signed by all or most of the medical officers, engineers, and surveyors under the local boards, and present it to the Government, in such manner as he may advise, so that this subject, which is of such primary importance, may be dealt with before next summer; then he thought the meeting would have proved to Mr. Weaver how they appreciated his paper on sanitation, which he had so recently read.

Mr. ALEX. A. KYD, C.E., referred to his district, where the sewers were small, so as to be well flushed, and where they had manholes with open gratings placed 100 yards apart, and means taken to prevent mud from getting into the sewers. Private drains were made under the provisions of the Public Health Act, which were enforced, but not more than half-a-dozen had disconnecting traps. Flushing did not altogether abate the nuisance of the openings in the streets. Every house-drain was trapped, but no other provision was made. He was not able to agree with the first of the four propositions of the paper. They had disinfectants at the openings in his district, and used Jeye's disinfecting fluid by placing cotton cloths in a hanging position. That was useful, but it was a matter of some expense. They had a number of dead ends, and to remedy this they erected shafts there, thus removing the foul air at the upper ends, fresh air taking its place at the lower ends. In an undulating district the foul air goes to the highest point, and the houses in that locality suffered. Hampstead had been mentioned in that respect; and the nuisance complained of was owing to there being no proper system of ventilating the metropolitan sewers. In the district

he was referring to the drainage was cut up in sections, which were dealt with separately. He did not think it was unworthy of good citizenship, as Mr. Weaver termed it, for a man to look to the best interests of his family and household. They ought to have a clear idea of what not to do in regard to legislation. What the householder had to do was to make a certain area clear of danger, and the public body to make another area clear of danger. He did not think the two were antagonistic.

Dr. SAUNDERS thought they should approach the matter at a stage earlier than ventilation. He was surprised to hear that the Metropolitan Board allowed such deposits as they had heard of that night. Such a thing would not be tolerated for a moment in a small town. In such a case, the contention, that flushing power should be adopted, fell to the ground, because it could not remove such an extraordinary deposit. One great reason why there was not a sufficient flushing power was because the closets were not properly supplied with water, and as a result the sewage ran intermittently. They ought to have power to insist upon water-supply to closets under the Public Health Act, as was the case in the metropolis, but it was necessary to prove a nuisance before this could be done. One great mistake was that engineers starved the sewers, and kept out all the water they could, so as to get it on the land. The treatment of sewage and the character of the sewers should be the first care, especially as to manholes. It was often found that a ledge is made below, and solid excreta often become deposited on this ledge, and that was one cause of manholes smelling. He could not but think that the recommendation of Mr. Weaver, to ventilate house drains from the sewers, was a dangerous and inefficient one.

Dr. GWYNN said Mr. Nidd Smith had spoken of the sewer air rising up under conditions of the atmosphere to the higher levels. At Hampstead they had two very large main sewers—the Fleet and the Ranelagh—and they found that there was a great up-flow of air. That had been a very burning question at Hampstead, and a sort of "drain committee" had been formed, consisting of medical men and inhabitants, who maintained that an outbreak of diphtheria was due to the emanation from the street ventilators. He got out statistics of the disease in London as compared with Hampstead, and found that they compared favourably with the metropolis. An outbreak of scarlet fever was also put down to the connection of Hampstead with the main sewers, but he found that when Hampstead was drained into cesspools the death-rate from zymotic disease was twice as great

as at present. They had, at Hampstead, tried to lessen the complaints by putting up shafts. The Metropolitan Board had been appealed to as to erecting shafts, but the reply had always been "ventilate your dead ends and flush"; but every dead end in Hampstead was ventilated. If there was no proper ventilation of sewers in the metropolis, what would be the condition of Hampstead on the high ground?—they would be the great ventilating shaft for London.

Mr. WALLACE was of opinion that house drains should not be used for the ventilation of pipe sewers. In 1876 his Board adopted by-laws and regulations with respect to drainage and ventilation. His views of ten years ago in reference to soil drains were still the same. He had found that complaints of smells were very much exaggerated, and often non-existent, but they wanted better cleansing of sewers. His Board had spent, year by year, £1,000 to extend dead ends and to connect them with the sewers further on. He had sometimes temporarily dammed up the sewers, and diverted a large quantity of water, and wherever he had done that there had been no complaints of smells. He had never been refused permission to carry up ventilating pipes in front of the house, and wherever he had done so the complaints had ceased. It was a great mistake to have street gratings not sufficiently near together, and there should be more of them, although they might not be the best means of ventilation. With regard to the high shafts, great care should be exercised in their construction. In some shafts the draft was always downwards, and in some it varied, and it was very necessary to know in which direction the current lay. There was no power in Acts of Parliament to compel owners of private houses to alter their drains. The work must be done at the expense of the local authorities, and any permission would be more likely to be given to ventilate the houses then.

Mr. KINSEY generally agreed with Mr. Weaver, and also corroborated the experience of the last speaker. He thought, too, that engineers were too fond of keeping the storm-water from the sewage. His experience had, however, been more of the separate system of sewage than is the case with the metropolitan system. Of course if this storm-water is allowed to go into the sewers, they must be very large; but then, again, if the size of the sewer was not so large, why should not the sewer flush itself? Under the separate system, they had a known quantity of sewage, and the sewer was of a certain size. If the drains passed under the house they should be ventilated, and the pipe should be placed in front of the house and the soil pipe at the back.

Mr. LOVEGROVE advocated the ventilation of the sewers by the

public authority, and the junction of dead ends by means of a six-inch pipe with shaft. He referred to the uncertainty of action of so-called inlets and outlets, and expressed the opinion that all openings intended for inlets should be fitted with talc valves, which would close them if the current were reversed.

Mr. WEAVER (in reply) stated he had to thank the meeting for the cordial manner in which his paper had been received, and to express satisfaction at the interesting discussion which it had evoked. The whole of the speakers unanimously agreed with him that the diffusion of sewer-gas is preferable to its confinement in the sewers, and the public surveyors who took part in the debate also endorsed his statement as to the increasing complaints of stenches arising from the open street grids; and it must be apparent that in districts (such as Kensington) where intercepting traps are being fixed to nearly every new drain, that the nuisance complained of will continue to increase, unless a remedy is applied, and such remedy, in his opinion, to be effective, must be radical and general. One of the speakers stated that a perfect system of sewerage negatived the creation of sewer-gas; most likely it does, but they were considering a system which falls far short of perfection. Improved legislation would doubtless improve it, but he feared that more than law is required to make it perfect. In a small provincial town, with ample powers and adequate engineering skill in the directory, something nearly approaching perfection may be attained; but they had only to consider for a moment the system under which the branch sewers of the metropolis are constructed to see that, in the latter area, anything like a perfect system is unattainable. The 18 & 19 Vic., c. 120, sec. 69, enacts that vestries shall make, repair, and maintain sewers for the proper drainage of their several districts; but, as a matter of fact, nearly all the sewers (except reconstructions) in the metropolitan area, as defined by the said Act, are built piecemeal, by owners and lessees, when developing building estates. The work is, of course, executed under the superintendence of the vestries, and good workmanship can be insisted on; but, under such patchwork system, an unity of arrangement and scientific adjustment of levels cannot be obtained. If the owner of a piece of land elects to lay it out for building, the houses erected have a right of drainage if there is a sewer within 200 feet; that sewer may, from a scientific point of view, be the wrong outlet, but there is no power to make the said owner construct, say, half a mile of sewer through an adjoining owner's land, in order that the right outlet may be reached. In his

own district, at the present time, there is an estate which cannot be further developed—owing to the fall of the sewers being adverse to the slope of the land—until the land at a lower level is laid out and sewered. Another point with regard to the construction of sewers is the power of the Metropolitan Board (25 & 26 Vic., c. 102, sec. 83) to make by-laws, for the guidance and control of the vestries, as to the making, ventilation, and cleansing thereof, and this power, which, as far as his knowledge extends, has never been exercised, might, he thought, be usefully put in motion. Dealing, then, with sewer-gas and sewer smells, as they are and as they are likely to be, he thought that what may be termed the doctrine of diffusion is the right one, and it only remains to determine upon its best form of adoption. Messrs. Turner, Armstrong, and Mark Judge expressed opinions strongly antagonistic to the sewers being ventilated through pipes attached to houses, and suggested that it is the duty of the local authorities to keep the sewers clean and ventilated. Mr. Judge further stated that from his experience of local government he would be sorry to trust to the supervision of the local authority for insurance against badly formed drains, and urges therefrom the danger of allowing sewer-gas to pass through the same. He (Mr. Weaver) admitted there would be an element of danger under such circumstances, but he thought Mr. Judge's experience in local government had been perhaps somewhat unfortunate. As stated in his paper, the views therein expressed are derived solely from 25 years' work in Kensington, where from three to seven hundred drains are annually constructed under the supervision of his department. Every drain in progress is visited once or twice daily, and no part of the work is allowed to be covered up until inspected and passed; and, with the help of three or four assistants, he believed he could thus insure good work. Whether drainage work is supervised in a similar manner in all the other metropolitan parishes, he was not able to determine, but he knew of no more important duty imposed upon vestries than the supervision of the drainage of their several districts. By the 76th sec., 18 and 19 Vic., cap. 120, it is enacted "that every drain shall be made in such manner and form, and of such material and workmanship, as the vestry shall order, and the making of every such drain *shall* be under the survey and control of the vestry." It will be seen, from this recital, that the duty thus imposed, is not *discretionary*, but *imperative*, and if some vestries, as asserted, fail to obey the law, powers exist, and should be invoked, to enforce obedience. With imperfectly constructed drains, he admitted that the adoption of his

plan would entail risk, but he was of opinion that in a matter of such vital importance to the public health, the work *should* receive the statutory supervision which is directed; if, however, the public demand private superintendence, then the law should be amended accordingly; but the supervisors should be properly qualified engineers, certified as to competency by some central authority. With an uniform system of perfectly constructed drains, and the illegal interference therewith made penal by fresh legislation, in conjunction with the other suggestions set forth in his paper, would, he was convinced, afford the most reliable remedy for the growing evils arising from the present method of sewer ventilation and house sanitation.

THE ACTION OF DISINFECTANTS ON MICRO-ZOOIDS.

BY A. WYNTER BLYTH.

(*Read: March 20th*, 1885.)

SINCE it is generally accepted that pathogenic micro-zooids exist, *i.e.*, minute organisms capable of living in the tissues of animals, and producing disease, a study of the conditions causing the death of micro-zooids is essential to the Health Officer; a knowledge of these conditions not being merely one of curious interest, but giving a direction to the most important work he has to perform.

The maladies which may be proved to be caused by a micro-zooid are—

1. *Diseases of Animals.*—The septicæmia of the rabbit; the septicæmia of the mouse; the anthrax of animals and man; a fatal disease produced in the guinea-pig by the micrococcus tetragenus; bovine tuberculosis; fowl cholera; glanders; malignant œdema.

2. *Diseases of Man.*—Human tubercle; erysipelas; some forms of pneumonia; acute osteomyelitis.

There have also been found micro-zooids associated with diphtheria, scarlatina, small-pox, enteric fever, cholera, relapsing fever, and some others, but the exact nature of the connection of the small life forms with these diseases cannot be said to be satisfactorily settled, although the balance of evidence points to the generalisation that zymotic diseases generally are caused by the multiplication of minute parasites; and it may be that hereafter a zymotic disease will be recognised as simply an expression of the effects of legions of micro-zooids, feeding on individual megazooids.

The micro-organisms, microbes, or, as I would prefer to call them, micro-zooids, are, so far as we know, not different in their organic requirements from larger life-forms—they require oxygen, taking it either direct from the air or from liquids, and they exhale carbon-dioxide; they are destroyed by a sufficient degree of heat, their activity is arrested by a sufficient degree of cold, and their vitality is also affected by certain substances such as those that have been called disinfectant, and, as I hope to show, by certain alkaloids, which have not hitherto been classed as disinfectants.

With regard to the term disinfectant, I shall, in this paper, use it

as identical with the term "germicide". A colony of micro-zooids, steeped in a solution of a chemical substance—taken from thence, carefully freed from the chemical, and then placed under the best possible conditions for growth, either shows no signs of life, or it develops and grows. If it shows no sign of life, it has been disinfected, that is, killed. Hence, according to this view, disinfection is either a destruction of pathogenic micro-zooids, or a poisoning of them, the end effect in either case being, for practical purposes, the same. On the other hand, antiseptics may be those substances which, added to soils in which a micro-zooid would otherwise grow, inhibit growth by their presence.

In 1883 I made a large number of experiments on spore-anthrax, that is, anthrax bacillus in the spore state, which seems to be the most resistant of all known micro-zooids; the methods used, and full details, have already been published in the *Transactions* of the Royal Society of Edinburgh; I will only give here the briefest summary of the results.

The following substances did not disinfect spore-anthrax:—An alcoholic solution of phenol, 5 per cent.; Calvert's carbolic acid powder; liquor carbonis detergens, 10 per cent; Jeye's fluid, 5 per cent.; pixene, 10 per cent.; Sanitas fluid, Sanitas oil, and Sanitas powder; Morgan's fluid; a saturated solution of sulphate of iron; a saturated solution of sulphate of copper; a saturated solution of sulphate of zinc; a strong solution of chloride of zinc; a solution of chloride of zinc and thymol; a solution of perchloride of iron, up to 25 per cent.; a 10 per cent. solution of terebene in strong alcohol. On the other hand, 10 and 25 per cent. solutions of phenol in alcohol, undiluted liquor carbonis detergens, and 1 per cent. solution of corrosive sublimate, acting for twenty-four hours, so far affected the bacillus that no farther growth could be obtained on nutrient gelatine; besides which a 25 per cent. solution of cresol in alcohol, a 10 per cent. solution of pixene, and a 5 per cent. solution of phenol, all delayed growth, more or less; that is, there was a certain amount of disinfection produced.

Within the last year there have been published some researches on the action of disinfectants of great value. I would specially direct attention to the researches of Schiff and Fischer on phthisical sputum,* and one by Fischer and Proskauer on the action of chlorine and bromine.

Schiff and Fischer in all cases used sputum, which abounded not

* *Mittheilungen aus dem Kaiserlichen Gesundheitsamte.* Berlin, 1884.

alone with bacilli but also with spores. They tested their results by the inoculation of animals. Passing over their experiments with old sputum, the main results were as follows:—Fresh tuberculous sputum boiled for any time more than two minutes had its power of infection destroyed ; a dry heat of 100° was always successful in disinfecting dried sputum, if prolonged over the hour, but not always successful if acting for a less time. Steam at 212°, passed over dried sputum, disinfected with certainty in half an hour.

The following chemical agents, acting for twenty-four hours, failed to destroy fresh sputum:—Creosote water, 1 per cent.; alcoholic solution of thymol, 1 per cent.; arsenious acid in water, 1 per cent.; saturated naphthalin water, 1 per cent.; the iodides and bromides of the alkalies, 1 per cent.; bromine water, 1 per cent.; iodine water, 1 per cent.; saturated iodine water ; absolute alcohol added to sputum in equal proportions, also when added in the proportion of three of alcohol to one of sputum ; phenol when added in such proportion that the phenol in the sputum would be 1.25 per cent.; corrosive sublimate solution (1-500) ; solution of soda, 2 per cent.; solution of potash, 10 per cent.

The following chemical agents were, more or less, successful:—Absolute alcohol, in the proportion of five parts of alcohol to one of sputum, acting for twenty-four hours (this mixture was inoculated into six guinea-pigs, one only became tuberculous) ; equal parts of a sputum and absolute alcohol, acting for twenty-four hours, when inoculated, failed to infect five animals ; 3 per cent. solution of phenol, acting for twenty hours, disinfected ; 5 per cent. solution of phenol, acting for two hours, did not disinfect with certainty—of the two animals inoculated one remained healthy ; strong caustic ammonia disinfected ; a saturated solution of aniline water, mostly disinfected, for out of nine animals inoculated, six, or two-thirds, escaped infection.

Of all the chemical substances experimented upon by Schiff and Fischer, carbolic acid is the only substance likely to be used, and it is evident that it must be employed, not alone in strong solutions, but the disinfectant must be allowed to act for a considerable period of time.*

* While upon the subject of disinfection of tuberculous sputum, the experiments of Dr. Klein, with phenol-propionic and phenol-acetic acids, made pretty well on the same lines as those of Schiff and Fischer, may be referred to. He found that although these acids effectually disinfected swine plague virus, yet their action for twenty-four hours on tuberculous matter was without effect.

The other important research is that of Fischer and Proskauer, on the action of chlorine and bromine.*

I shall only give a brief summary of the results of the chlorine experiments. The evolved gas was passed into glass vessels, in which were contained various micro-zooids. The effect produced was tested by the inoculation of animals, or by cultivation, or by both methods. The experiments having the most direct bearing upon practice were those made in a cellar. The experimental cellar cubed 28 mètres, that is, 988 cubic feet. A little over 13 lb. of chloride of lime was divided into twelve separate quantities, and, in their most successful essay, the hydrochloric acid was so arranged as to mix rather gradually with the lime; presuming that all the chlorine was expelled, the amount of gas at the standard temperature and pressure would be 1531.6 cubic feet. To this strong atmosphere, at various heights from the floor, in various places, and either freely exposed or partially protected from the gas by wrapping in filter paper, were submitted the following:

1. Spore anthrax.
2. Anthrax in the bacillus form.
3. Rosa-hefe, or red yeast.
4. Orange-coloured sarcina.
5. Garden mould as a substance containing many different forms of minute life.
6. Aspergillus niger.
7. Mouse septicæmia.
8. Rabbit septicæmia.
9. Blood from the heart of a guinea-pig, which had died from inoculation with the micrococcus tetragenus.

These various micro-zooids represent very fairly both pathogenic and non-pathogenic forms, varying in resistance from the delicate mycelium of a fungus, up to the pachyderm of the class,—spore-anthrax.

They had found, from previous experiment, that chlorine in the dry state, acting on dry matters, was uncertain in its results, and that the gas disinfected most when in contact with moist air. A large quantity of water was therefore evaporated in the cellar, previous to the evolution of the gas. The cellar was closed up as perfectly as possible for twenty-four hours. The micro-zooids on the floor, and also those near the roof, freely exposed to the gas, were dead, that is, disinfected. Of those wrapped in filter paper, the aspergillus niger

* *Mittheilungen aus dem Kaiserlichen Gesundheitsamte.* Berlin, 1884.

and the sarcina alone were killed, the rest were living. The micro-zooids in the middle of the room, raised from the floor at various elevations, and exposed without any protective covering, were all destroyed, save the anthrax spores and the orange-coloured sarcina. The micro-zooids wrapped in filter paper placed near the roof, also those elevated at the height of a mètre above the floor, were not destroyed, save the micrococcus tetragenus.

Leaving the practical bearing of these observations to be discussed at a later period, I would wish now to communicate to the Society some few experiments of my own in continuation of my former research.

Having, through the kindness of Dr. Watson Cheyne, been furnished with a pure cultivation of mouse septicæmia, threads infected with the bacillus were submitted to the following disinfectants, some of which are in commerce:—Tuson's disinfectant; a saturated solution of sulphate of iron; Morgan's fluid; a 10 per cent. alcoholic solution of cresylic acid; chlorozone; a 10 per cent. solution of sulphenic acid; a 20 per cent. solution of zinc chloride.

The infected thread was allowed to soak in the disinfectant for two hours, and then entirely freed from the disinfectant by soaking in water or weak alcohol, according to circumstances, the control threads being, of course, washed in the same manner; these threads were now embedded in nutrient gelatine, and cultivated at the ordinary temperature.

The following disinfected the thread completely:—The alcoholic solution of cresylic acid, and the solution of sulphenic acid. The threads treated by Tuson's disinfectant developed growth much later than the control. The threads treated by chloride of zinc and chlorozone also developed growth later, and sparingly. The sulphate of iron, as well as Morgan's fluid, had no effect, not even delaying growth.

I am not able to say whether the bacilli were in the spore state from direct observation, for the elements of mouse septicæmia are so extremely minute, that the perception of spores, even with the highest powers, is a difficult matter; but that there were spores present is pretty well established by the resistance.

I have also made many experiments with the pneumonia micrococcus, with the general result that it is, so to speak, a tender micro-zooid, with but feeble resistant powers; but the experiments require repetition and confirmation. My most recent study in connection with disinfection has been made upon a bacillus raised from the

purulent nasal secretion in the latter stages of a catarrh: it grows very rapidly, liquefies gelatin, and the solution is of a yellow colour and fluorescent; there is little doubt that it is closely allied to the bacillus producing the green colour of pus. It forms spores, and is but moderately resistant; it is not pathogenic.

Mr. Benj. Nickels kindly placed at my disposal nearly pure samples of members of the pyridine series—pyridine, collidine, picoline, and acridine: 10 per cent. solutions of these bases were made in water or weak alcohol, and infected threads soaked in the solutions for twenty-four hours; the experiments were made on quite the same lines as the former, that is, with regard to the freeing the threads from the disinfectant, and the cultivation on solid nutrient gelatin. The control thread exhibited rapid growth, but not one of the others showed, even at the end of fortnight, the least sign of life, so that with regard to this not very resistant micro-zooid, disinfection was perfect.

In another experiment it was endeavoured to ascertain how far small quantities of pyridine, when present, inhibited growth. A drop of slightly sour milk was diffused through four litres of sterilised water; a drop of this contaminated water was now placed in each of two flasks, the flasks were conical and had flat bottoms; sufficient nutrient jelly, which had been melted at a gentle heat, was now mixed in the flask with the drops of water, and to the one flask was added 1 c.c. of a 10 per cent. solution of pyridine. In a few days growth commenced; in the flask to which the pyridine had been added there were two centres of development, while in the other over 100 were counted. The inference is that the pyridine had either destroyed the micro-zooids present, or else inhibited their growth.

As the members of the pyridine series had some disinfectant action, the research was extended to the empyreumatic products formed in the ordinary smoking of tobacco. The smoke from a single pipe of tobacco (shag) was passed through a few c.cs. of water. In this solution of pyridine, and perhaps some nicotine, threads contaminated with the yellow bacillus were soaked for twenty-four hours, and afterwards freed from the solution by soaking in water and in alcohol. On placing the threads on nutrient gelatin, growth was rapid around the control threads, but not around any of the others.

A precisely similar experiment to the pyridine experiment with water contaminated by a drop of milk was also made. The gelatin

in the flask mixed with a little of the tobacco water developing very few centres of growth, the control flask very many.

I have also commenced experiments as to how far the life of this particular micro-zooid is affected by the poisonous alkaloids. The results so far are very interesting, for my infected threads, soaked for twenty-four hours in a 1 per cent. solution of neutral salts of morphine, narcotine, papaverine, strychnine, or of atropine, no longer exhibited growth when cultivated on nutrient gelatin.

The conclusions to be drawn from these various researches are, I think, pretty obvious. Disinfectants, when they are not destructive agents, act as poisons; they poison the micro-zooid in a not essentially different manner to the lethal poisoning of the higher life-forms. The existence of a non-poisonous disinfectant, in my sense of the word, has not been proved; those in common use, and on the action of which we have most trustworthy evidence, such as corrosive sublimate, carbolic acid, and chlorine, are all powerful poisons.

I have shown that, so far as a rather easily destructible non-pathogenic micro-zooid is concerned, the products distilled in the act of smoking are disinfectant, hence the widespread notion of the prevention of infection by smoking, may, after all, have some foundation.

I will, lastly, make a few remarks on practical disinfection. All modern experiment has shown clearly and decisively that the full action of chemical agencies on micro-zooids require *time*. A 5 per cent. solution of phenol, acting for a few minutes on specific excreta, may disinfect superficially; but such excreta passing into sewer or cesspit, and therefore by dilution removed from the influence of the disinfectant may, under favouring conditions, be potent for evil. The direction, therefore, to be given in the disinfection of typhoid, or choleraic excreta, should be not alone to receive it in a strong disinfectant, but to allow a sufficient time for the disinfectant to act.

In the fumigation of rooms after serious infectious illness, chlorine seems to be the only practicable gaseous disinfectant, the properties of which have been placed beyond doubt. The ordinary method of evolving chlorine should be improved, and I would suggest the following process, in cases where it is necessary to disinfect as perfectly as possible.

For every thousand cubic feet of space use 3 lb. of chloride of lime and 3 lb. of commercial undiluted hydrochloric acid. The cracks and openings of the room are to be stopped up in the usual way with brown paper and paste. The chloride of lime should now be divided

up into several parts, and placed as near the ceiling as possible in deep pans. The evolution of chlorine should be arranged to take place in such a manner as to permit of the escape of the operator before the reaction commences, and there is no more convenient method than to allow the acid to flow from glass vessels provided with stop-cocks into small beakers placed on the chloride of lime; there is then no evolution of chlorine until the beakers overflow. Previous to the fumigation, the air of the room should be saturated with aqueous vapour, and any steel articles protected from the corrosion of the gas by a good coating of vaseline or varnish. The room should be sealed up as hermetically as possible for twenty-four hours, at the end of which time it is further necessary to remove all things capable of being moved, to be submitted to a steam heat in a proper disinfecting apparatus for many hours. Lastly, I would strongly recommend washing the boards with a solution of corrosive sublimate (1 to 1,000).

Discussion.

In the discussion which followed, the president, after moving a vote of thanks to Mr. Wynter Blyth for his interesting paper, observed that the subject of it had been dealt with more than once in recent years by the Society, papers having been read by two former presidents, the late Dr. Letheby and Dr. Thomas Stevenson. The importance of the subject justified reconsideration of it from time to time. He could not help contrasting the results of disinfection, as commonly practised, with the views of the reader of the paper. Speaking from personal experience, he was able to assert that disinfection of the sick room and its contents was, in practice, a success, notwithstanding the views propounded by Mr. Blyth, as to the extreme difficulty of killing the organisms which were supposed to be the seeds of infection. He appealed to the practical experience of other medical officers of health whether this was not so, and whether they could not confirm his statement that when disinfection was carried out carefully after the usual manner, infectious disease did not reappear in the disinfected house, always supposing that at the time of disinfection such disease was not in process of incubation. Occasionally disease—especially scarlet-fever—reappeared after the return of a patient from the hospital; and he suspected that, although the skin of the patient in such cases had apparently done peeling, there might be infectious matter entangled about the roots of the

hair. He believed that occasionally the reappearance of disease was due to the reservation from disinfection, by the owner, of some cherished article of clothing, etc., that had been exposed to infection. But cases of recrudescence of disease were few indeed in comparison with the total number of rooms, etc., disinfected. As to the material used, Mr. Wynter Blyth preferred chlorine, and had suggested the use of varnish, etc., to protect metal surfaces from the attack of the germicide. Would not the coating protect the germs also? Dr. Thomas Stevenson had employed bisulphide of carbon at St. Pancras, and had every reason to be satisfied with the results. In common with the majority of his colleagues, he himself used sulphurous acid, and he was well satisfied with it as a disinfectant, despite what Mr. Wynter Blyth had said regarding its inefficiency as a germicide.

Dr. ILIFF, of Newington, agreed with the president that the method of sulphuring rooms had yielded trustworthy results, and for the last twenty-eight years he had relied on this method of disinfection. He doubted whether the great expense attending the disinfection of bedding and clothing by superheated steam was quite warranted, as he had never had reason to believe that the less expensive apparatus of Dr. Ransome had failed to do its work effectually.

Dr. C. E. SAUNDERS took exception to the term micro-zooid. He thought that scientific terminology should not be further complicated by new names, except for very sufficient reasons. This name was really misleading, as it designated as small life-like forms those which were, in reality, life forms, which meaning was properly conveyed in the word microbe.

Mr. KINGZETT spoke of the destructive effect of chlorine upon the tints in the apartments, and in rusting steel and iron. He admitted that there are some diseases—anthrax, for instance, and a few others —with which there was a very direct connection between them and certain micro-organisms, but he did not think that these micro-organisms were the cause of the disease. It was to chemistry that they must look as to what constituted the diseases. The speaker then proceeded to review the experiments of Pasteur and others, and said he differed *in toto* from Mr. Blyth. He compared the sanitas fluid with chlorine, and claimed for his products all that could be claimed for reliable disinfectants. He was now making further experiments, which he hoped to bring before the Society.

Dr. MOORE said he had entered as a pupil at the Laboratory at the Health Exhibition, so as to settle in his own mind some points

of this question. He thought it must be owned that micro-organisms are the cause of certain diseases. The yeast plant produced alcohol in the fermentation of sugar, and others produced putrefaction and certain acids, and everybody must know that some produced anthrax. If a poison from an animal's body is inoculated into another animal, it dies of the same symptoms. But it must be admitted that in a great many of the diseases the effect of this micro-organism is not proved, and perhaps never would be proved from direct observation, because many of the organisms are so small, some so small that they never will be seen even by microscopical observation. He did not agree with all Mr. Blyth said, and thought it would be only by experiment in the way he (Mr. Blyth) had pointed out that the fact would be proved that micro-organisms were the cause of scarlet-fever, etc. If something could be found that would, beyond doubt, prevent the organisms from carrying disease, it would be a great step. He could not agree with Mr. Blyth when he said that all disinfectants must be poison. The speaker was strongly of opinion that some disinfectant could be found which was not so. There was a book published by the Health Exhibition authorities on "Fermentation", and there was one paragraph in it which struck him that some non-poisonous disinfector might be found. It was upon an experiment made by a French gentleman upon a fungus, and it was found that this plant could be grown under certain conditions. Steel was taken, and the growth was increased, and, if other things were added, the growth decreased. Silver was one of these. This was added, and the growth was completely stopped, and the plant was so sensitive that it would not grow in a silver vessel. He believed that it was probable that some disinfector would be found, as the silver acted upon the plant. He thought Mr. Kingzett was right as to chlorine being so destructive; but, practically, he agreed with the President as to disinfecting the rooms by burning sulphur, taking off the wall papers, whitewashing, scrubbing the floors with carbolic, and having the clothes disinfected by heat; and this last point was an important one. Their secretary (Dr. Saunders) had taken the words out of his mouth as to an objection to the term "micro-zooids" used by Mr. Blyth.

Mr. CORNER confessed to some disappointment on the reading of Mr. Blyth's paper, because they would go away with no better means of disinfection than they had at present. It appeared to him that chemists, after directing their attention to this subject, told medical men that what they had been doing was utterly

valueless. Mr. Blyth's experiments appeared to have been directed towards a class of cases which they did not often deal with, and he had not applied his tests to small-pox, scarlet fever, and typhoid. It was in this direction that they wanted ground upon which to work. How did Mr. Blyth explain the disappearance of disease from a large number of houses in which no disinfection had been practised at all —perhaps one-half? What became of the infection in the remainder? It must die out, and, if so, what was the cause of it? If they could only stop the growth of these poisons for a time, until they were issued from the premises, and had disappeared into the drains (and the drains, if fairly disinfected, were not vehicles for disease), that would be something gained. He thought Mr. Blyth might, perhaps, have given them his opinion upon the experiments of Professor Lister's work, because from those experiments he believed they might be able to gain something very important. With regard to alcohol, he might refer to Mr. Hutchinson's practice. He (the speaker) had used it in hospital practice in the case of wounds and amputations; and he found a solution of spirit—one in three—had a powerful preventive effect in the cases of erysipelas, hospital gangrene, etc. Another point was that in disinfecting rooms the clothing of the people was left untouched; but if there was only one room, what was to become of the people, who, perhaps, had no change of clothing? An institution was really needed in which poor people could enter to be bathed, and their clothing disinfected by heat. In twelve or twenty-four hours a system of disinfection could thus be carried out. The present system in such cases was only a half-measure. In Poplar he used sulphur and dry heat, but he was not sure that it was not the turning out altogether and the general cleansing that did the good. He had experienced difficulty in destroying the infective character of threads used for ligatures, and this bore out the statement of Mr. Blyth, that microbes attached themselves to threads with great tenacity.

The PRESIDENT remarked that with reference to Mr. Corner's statement as to the disease not appearing again when no disinfection had taken place, and as to the disease having died out, that the poison had not always died out, perhaps for long afterwards. He knew of a case in the country where the infection of scarlet-fever had shown itself twelve months after the first outbreak.

Dr. WILLOUGHBY said that, with regard to Mr. Corner's remarks as to the disease dying out, they would only apply in some cases, because the persons who were most susceptible would succumb, while

those who were not susceptible would escape, but a new comer to the place, perhaps months after, would contract the disease. The speaker then referred to many authorities on the subject, concluding by suggesting that experiments should be made in respect of small-pox, enteric fever, etc.

Mr. WYNTER BLYTH, in reply, said, with regard to the observations of the president as to whitewashing, taking off wall-papers, etc., that similar precautions were adopted by him. As to the difficulty of using chlorine, he might have rusted the steel and the fire-grates and destroyed the tints of the apartments, but he did not mind that so long as he disinfected the rooms properly. Dr. Saunders had taken exception to the term micro-zooid, but the term "zooid" was very extensively used by all writers on zoology. He rather preferred the term, although it might be open to objection. He had received a paper from Mr. Kingzett, but he had not read it, as he wished, whilst making his experiments, to remain perfectly unbiassed. Dr. Moore had stated that there would be a non-poisonous disinfectant found, but it had to be found. He did not dispute that the ordinary disinfecting operations do get rid of a large amount of infection, but not all of it. With regard to experiments upon scarlet-fever, measles, etc., they could not get the matter to experiment upon.

ON SEWAGE DISPOSAL.

By THOMAS STEVENSON, M.D., F.R.C.P.

(*Read: April 17th*, 1885.)

The disposal of sewage presents a problem which at the present moment is engaging the anxious attention of nearly all town, and very many rural, communities in this country. Happy are those peoples who, with Arcadian simplicity, can still satisfactorily get rid of their excreta, like those of animals, by disposing of them upon the soil, with advantage to the crops, permanent benefit to the soil, and safety to the population; a cleanly, convenient, and economical practice, but one, alas! which is now applicable to only a comparatively few of the inhabitants of this island. The processes, inorganic and organic, by which effete matters are got rid of by the soil, can be but feebly imitated by man; yet it is by the study of these processes, and their more exact imitation, that we must look, I believe, for a more satisfactory disposal of sewage in the future.

The primitive plan of depositing excreta directly upon the soil, was followed by the more decent habits of the people in depositing, as a matter of course, these substances in privies, etc.; and comparatively few evils probably resulted from this practice, until the method was applied to large populations in our towns; and it is, perhaps, not too much to say that we have here a signal instance of failure from the well-known, and but little appreciated cause of a vast number of the failures in practical affairs—the application of a method of procedure, well adapted to one set of circumstances, to another, without reference to its adaptability to new circumstances—the lack of inventive faculty, in fact. We are always endeavouring to adapt the square, well-fitting peg to the round hole, with the inevitable result of a failure of adaptability. The privy, situated as it still is in old-fashioned country houses in some secluded spot, was for a convenience brought nearer and nearer to the house; and where available land is limited, as near towns, even invaded the dwelling;

dangers immeasurably great being thus brought up to, and even within, the very doors of houses.

Happily these evils—in country places, at all events—are easily remediable by means of the modern earth-closet; and among such rural communities there need be no insurmountable, or even any considerable, difficulty in satisfactorily, and, as I believe, profitably, dealing with excreta; and sewage in its proper sense—that mixed fluid containing all the liquid or semi-liquid refuse of households—need not exist. I may therefore pass this matter by without further comment. I will rather deal with town sewage, for it is with this that the greatest difficulties arise.

When people began to aggregate in large centres—and this for my purpose may be taken as, roughly speaking, coeval with the last seventy years—the post-Napoleonic period—they naturally adopted the most convenient system followed in lesser communities, the cesspool system, then universal in mansions. So long as the nose was not greatly offended, the hiding away of excreta and other refuse in pits or tanks, which were periodically emptied, was the system that commended itself to the people. The sanitary evils connected with this system were not understood, and it presented many obvious advantages. Indeed, a cesspool system, as the Royal Commission on Metropolitan Sewage Discharge have recently reported, is one which many good authorities still believe, if efficiently carried out, is the best for municipal adoption. Whether this opinion be correct or not, for practical purposes it may be set aside in this country, as not within the region of practicable sanitation; although a cesspool system may be, under strict conditions, one worthy of careful consideration. At the beginning of the present century, and long after, cesspools were universal in London, then a large city; and although sewers existed, it was penal to use these for sewage. One manifest advantage, counterbalancing many evils, resulted from this system, that the river water was fairly pure, and drinkable at London Bridge. Indeed, many people of not very advanced age well remember the Water Works at London Bridge, opposite Fishmongers' Hall, for the supply of the City, and ships would take their supply from the river thereabouts before proceeding on long voyages. I know of no analyses or examinations of the river water at that date which enable us to compare the water as to its purity then with now; but manifestly the repulsive fluid which is now often observed at London Bridge is a much less pure liquid than was found there sixty or seventy years ago.

In 1810, three-quarters of a century ago, someone, whose birth will perhaps hereafter be celebrated in "centenaries", invented the *water-closet;* and, though prejudice at first militated against its adoption, its use since 1830 has been marvellously developed; and since that date innumerable engineers and others have spent their lives in trying to perfect the water-stoppers, by which we endeavour to cork out, if I may use the term, the gases in cesspools and sewers, and prevent their access into our houses, where the water-closet is nearly always placed. Indeed, people will not have it elsewhere. At first, in this metropolis at least, in consequence of the penalties attaching to the discharge of sewage or other offensive matters into the sewers, the liquid from water-closets was discharged into the cesspools that existed perhaps in all houses to which the modern convenience was adapted. The increased volume of liquid introduced into the pits speedily led to the necessity of providing for their overflow; and the practice sprung up, impossible to restrain, of connecting the overflow pipe with the street sewer. These, hence, became more offensive; such as were open had to be covered in, and thus the cleanly, convenient luxury of the water-closet became a source of anything but unmixed blessings. A more abundant water-supply, and the facilities which this afforded for the more general adoption of water-closets, tended to aggravate the evils consequent upon the new system.

In a few years the state of the law as to sewers underwent a complete reversal; and now, instead of the discharge of sewage into our sewers being a punishable offence, it is penal not to discharge into a sewer if accessible.

But this picture, however applicable to London, is not applicable to most of our large provincial communities. There the water-closet is not universally adopted: at Leeds, Bradford, Birmingham, etc., most of the houses are still unprovided with water-closets. In London a house without water-closet accommodation is indeed exceptional. There are, indeed, urban populations, such as that of Stafford, among whom a w.c. is phenomenal.

It might seem, therefore, at first sight, that sewage would be a substance so diverse and varying in composition, and, excluding all other considerations, so variable, according to the proportion of water-closets in the town whose sewage is to be treated, as to fill one with despair as to how it is to be dealt with; each town presenting a special sewage for treatment. Sewage does vary in its composition, and within wide limits. But the variation is, excluding the special

residua of manufacturing operations, one of degree rather than of kind. The organic materials around us are not only individually made up of the same few elementary substances ; but the proximate substances of which they are made up — the proteids, such as albumen, and carbohydrates, such as sugar and gummy bodies, are pretty much the same. And when they are not, the processes of putrefaction and decay speedily reduce all to one common mixture of a few ill-defined compounds, on their way towards an inorganic residuum. Indeed, it has been found that there is no very great difference between the strength of sewage of water-closeted and non-closeted towns : the proportions of organic substances, and hence of polluting materials, in the two being in the ratio of 6 : 5. Indeed, the human excrement in sewage forms but a small proportion of the polluting matter. Taking the average of a community, the dry solid excrement is 1 oz., which is distributed through 300 lb. of liquid : say some 15 grains per gallon ; and as for the urine, whilst the major portion of that of adult males never finds its way direct into the sewers, of the $2\frac{1}{2}$ oz. solids per head per diem distributed through 300 lb. of water, $1\frac{3}{4}$ oz. only is organic matter, one-half of which urea is speedily converted into innocent carbonate of ammonia. Indeed, although according to received views the solid excrement forms the most important polluting agent of sewage, it is by no means the greatest in aggregate amount, and indeed forms only a fraction—and that not a large one—of the total polluting material. The thousand and one articles of domestic economy greatly add to the organic matters of sewage ; and when all has become involved in one common ruin of decomposition, decay, and putrefaction, it is impossible to say that any one, or which chiefly, of the various constituents of sewage is the most potent in offensiveness.

It is, as I have said, of town sewage I wish to speak, and I cannot do better than speak of London sewage in particular ; for the sewage of this metropolis is a typical sewage. London sewage, coming from such a vast and unequalled population as to numbers ; from a population more mongrel than any other in our country ; from a city of no special manufacture or trade ; from an area of mean climate and rainfall ; and from a city more completely water-closeted than any other, represents the average sewage of the future—the sewage which will predominate when towns become more completely closeted. The difficulties attendant on the disposal of sewage can in no British town be greater, perhaps, than those which present

themselves in London : a site much of which is below river level, and very little of which is greatly raised above that level ; an immense area, an area so large that all prospect of disposing of the sewage by any means other than those involving water carriage is not to be thought of at the present day ; a city remote from the sea, with no available area close to its boundaries, and a situation near the upper end of the tidal reaches—here we have difficulties to encounter, which can scarcely be exceeded. And I would remark that a very large amount of credit is due to those who have hitherto dealt with the disposal of the sewage of London ; and shame be to those concerned now who, if after being unwillingly convinced, or if not convinced, convicted of neglecting to do all that is possible, do not at once manfully set themselves to do what can be done to mitigate and abate the nuisance of the Thames, a river which has so lately raised to heaven its filthy stench in cry for a remedy.

Sewage cannot be better defined at the present day than the liquid discharged from sewers. It is, in its crude state, a fluid containing a variable quantity of suspended or non-dissolved matter, and a less variable quantity of dissolved substances, some of which are mineral or incombustible, whilst others, and those deemed most liable to become offensive, are organic or combustible. This division is, however, somewhat crude and arbitrary. Some of the substances that remain as fixed residues in the fire, are present as portions of organic bodies in the sewage ; and again, it is by the mutual interaction of the decomposing organic matters, and some of the mineral constituents of water, viz., sulphates, that offensive sulphuretted hydrogen gas is generated. Such a semi-fluid is one very prone to change. It contains many not only organic but organised bodies ; and these are in a state of unstable molecular equilibrium, so that their molecules readily re-arrange themselves under the agency of external influences, and always to form simpler bodies ; the tendency being to revert to those simple chemical compounds which serve as the pabulum for the support of the higher forms of plant life. The older views of Liebig, which once prevailed but are now exploded, that the agency by which decomposition, and especially putrefactive decomposition, is effected, and a substance, say muscular fibre or albumen, is destroyed, is the presence of a catalytic body, *i.e.*, a body which in some unexplained way did not change itself, but set everything about it into a state of ferment or change—are no longer tenable. This mischievous body—the catalytic body—that sets all its neighbours to mutually destroy one another, is, by recent research,

found to be a being much more deserving of our sympathy and respect. So far from doing nothing but initiate—taking no point beyond that of the active busybody—the little organised being to which I have referred is doing its own proper work, living, growing, developing, reproducing, and in doing so acting as the scavenger of the universe; for it cannot live, grow, and propagate its species, without at the same time splitting up and decomposing organic bodies: in short, starting and carrying on putrefaction. These little beings, formerly but little regarded, and ranking as the lowest forms of vegetable or of animal life, have now high-sounding titles conferred upon them—lower organisms, lower fungi, have given place to schizomycetes, bacteria, bacilli, micro-organisms; but after all they are but the connecting links between the animal and the vegetable kingdoms—the apex of the V, one link of which is crowned by the lordly tree, the other by man, the lord and master of the earth.

Now sewage, when left to itself, very quickly undergoes putrefaction; and putrefaction means, to say the least, offence to the nose. The agents of putrefaction, bacteria, the spores of which are everywhere abundantly present, even in the atmosphere, find in sewage a nidus in every way well fitted for their growth and multiplication. What does the chemist or the physiologist when he wishes to prepare a medium in which to artificially cultivate micro-organisms? He selects a liquid containing all the chemical elements necessary for the growth of organisms, one containing abundance of ammonia salts, sulphates, phosphates, lime, potash, etc.; and one which is very dilute. Such a liquid is sewage. Man at his prime—arrived at his full growth—daily excretes, in one form or another, just as much assimilable material as he takes in; and hence his excreta—taking the term in its widest sense—must contain all the materials necessary for the growth of animal and vegetable organisms. Nature has kindly provided that excretary matters are got rid of; and the two processes by which this is effected are putrefaction and oxidation, and the former precedes in point of time. When putrefaction can proceed without offence and injury, then let it proceed; the dunghill is a useful institution, albeit not savory; but the exigencies of the modern sewage system demand that putrefaction of sewage should be kept in abeyance as much as possible, and that the alternative method of sewage treatment, oxidation, be as much as possible cultivated.

Now, as I have said, sewage is a liquid that very rapidly undergoes putrefaction. When fresh, and freely exposed to air, as in sewers only

partially filled, it has little odour, and can scarcely be considered offensive ; but once let it accumulate in large quantities, and come to comparative rest, putrefaction sets in, and it becomes vilely odorous—a seething mass full of those minute organisms which live, and grow, and multiply in an airless, a deoxygenated, medium. To prevent this the sewage must be dealt with in one of three ways, always presupposing, however, that the liquid is dealt with speedily, before putrefaction has set in : (1) the sewage may be at once thrown into a large volume of pure water, a river or the sea, where it can be carried away by currents, diluted by diffusion, and oxygenated by the dissolved oxygen, without appreciable nuisance ; (2) it may be applied directly to land of sufficient area to dispose of the sewage without offence ; (3) it may be treated with chemical agents such as either destroy the organic matters, or those that destroy the agents of putrefaction, the lower organisms. Of course there are subsidiary and ancillary means brought in aid ; and amongst these the so-called precipitation processes, which by many are claimed as belonging to the third means I have spoken of, but which are really not so.

The first of these methods of disposing of sewage was, of course, at first largely adopted, on account of its obvious convenience wherever the necessary river, or the sea, is at hand ; and "out of sight, out of mind" appears to have been the guiding principle. Of course terrible evils resulted. Where a river is employed, this is seldom large enough not to be sensibly polluted for some distance below the point of sewage discharge ; and granting the enormous oxidising capacity of the dissolved oxygen in river water, $1\frac{3}{4}$ cubic inch or $\frac{6}{10}$ grain oxygen per gallon—a quantity continually renewed by absorption from the atmosphere—the addition of raw sewage to river water is to be deprecated as dangerous to the health of the community. Although the dangers of spreading infectious diseases by this means have no doubt been exaggerated, it can scarcely be denied that the danger is a real one ; and the legislature has wisely said, and will again say, that untreated sewage shall not be permitted to be cast into any of our streams, whether or not these are to be subsequently used for drinking purposes.

It might, perhaps, be supposed that sewage could do no harm in the sea, where the volume of water is so vast, and, in our seas at all events, the tidal motions so considerable, that the sewage might be expected to be carried out to sea, and lost to the senses or destroyed by oxidation. Yet such is not the case. If sewage be thrown into

the sea near the shore, and at such a point as not to be immediately carried out to sea by the set of the currents, nuisance is always found to arise. Sea-water and sewage form, even when the latter is enormously diluted by the former, a peculiarly objectionable and offensive mixture. The organic matters of the sewage take, by a well-understood chemical change, oxygen from the sulphates so abundantly present in sea-water, reducing them to sulphides, whence sulphuretted hydrogen is liberated by the carbonic acid in the water. Everywhere the action has been found to be the same; and so potent is this reduction that it has been found that the flushing of sewers by means of sea-water, and the watering of streets with the same liquid, have proved sources of nuisance and offence.

But another objection has been raised to this mode of disposing of sewage, viz., that it is wasteful, and that it is wrong to thus throw away such an enormous amount of valuable manurial substances. The objection is one which ought never to be lost sight of. Passing by the theoretical estimates of the money value of human excreta as manure, let us turn to sewage—London sewage. This liquid is yielded in the proportion of rather more than one ton per week per head of the population. Now the money value of the manurial constituents of this ton of sewage, if they were in a solid and portable form, is twopence; but when they have to be utilised on land in a highly dilute form, in all weathers, the actual value is found to be only a half-penny; and I need hardly say that a half-penny per ton does not leave much margin for cost of transport. When the sewage has to be pumped, the cost of pumping exceeds the value of the article pumped. Where the sewage can be distributed on suitable and readily accessible land by gravitation alone, the case is different. The lesson of Doncaster sewage farm is in this respect most instructive. There we have a farm in every way suitable for the purposes of irrigation; gently undulating, so that the sewage can be distributed by gravitation; a gravelly soil, so that in dry weather the application of the whole sewage of Doncaster carries no visible effluent; and skilled, careful, and economical management. The sewage is delivered, pumped gratis, at the highest point of the farm. The net result is, no profit, expenses and income just balance, and the sole benefit, beyond the effective disposal of the town sewage, is, perhaps, an increased value of the staple of the soil. Great, then, as are the advantages of applying sewage to the land, no profit, but nearly always a pecuniary loss, must result from utilising town sewage in this manner. But it must not be assumed unhesitatingly

that when sewage is discharged into the sea, or even into a river, that the valuable constituents are lost. An eminent authority, Sir J. B. Lawes, argues that, in the case of the London sewage, the sewage is utilised by fish and other living creatures, which feed either directly or indirectly upon it; and that in this way large quantities of palatable and nutritious animal food are produced, which would, under a better distribution of our fish supplies, be available to those who contribute the sewage from which the fish draw their stores of nutriment.

But although the utilisation of sewage by its application directly to the land is, from a pecuniary point of view, rarely profitable, and most commonly entails a loss, this method is, no doubt, in principle the right one; a continued fertility of the land is dependent upon the restoration to it of the mineral constituents of the food grown upon it. There is, moreover, no agent known which so efficiently deodorises sewage as the soil, which acts not only as a checker of putrefaction, but also absorbs the gases of sewage; and, further, is the nidus of the well-nigh demonstrated nitrifying organism, *i.e.*, the bacterial organism by which ammonia and nitrogenous organic matters, immediately, or mediately through the intermediate stage of ammonia, are converted into nitrates. That this organism does exist we are convinced by the researches of Sclœsing and Müntz, and still more by those of our English chemist, Warington—experiments which have shown that, from a chemical point of view, there is a vast body of evidence cogently pointing to the existence of such an organism; but this organism has not hitherto been detected by the eye, aided by the microscope. This actual discovery is, nevertheless, I cannot doubt, imminent. The habits of the organism—for I may be permitted to speak of it as such—are those of other kindred organisms; its activity is checked, or it is destroyed, by the chemical substances generally which check or destroy the activity of other low organisms; the seeding or inoculation of a soil with a nitrifying soil causes the former soil to become abundantly nitrifying, just as the impregnation of a saccharine infusion with another liquid containing an organism (yeast), sets up alcoholic fermentation in the impregnated liquid. Further, the nitrifying action is limited to the superficial layers of the soil, decreasing rapidly as we descend, till at 18 inches below the surface the action entirely ceases. The recent discovery that nitrification is limited to the superficial layers of the soil, serves to explain how much more potent in disposing of sewage is the surface of the soil than the lower strata, and how by increasing the depth of

soil permeated by sewage, as by converting surface or broad irrigation into filtration, by doubling the available depth of soil, we cannot make the same area dispose of twice that bulk of sewage. The deeper layers of soil can absorb the organic constituents of sewage, and on aëration these are eventually destroyed; but when the nitrifying organism is present, this acts in aid of the ordinary chemical actions going on in the soil.

My hearers will forgive me, if, for the sake of the younger among us, I explain that broad irrigation means the application of a minimum quantity of sewage upon a maximum area of land, so as to obtain the greatest amount of utilisation combined with purification; that in this system the sewage is allowed to flow over the land on which crops grow, and that no special drainage is employed, the bulk of the liquid simply flowing over the land to the effluent carriers, and no large proportion of it filtering through the land. In filtration, on the other hand, the minimum of land necessary for purification is employed; this has been hitherto deeply drained, the sewage being intermittently applied to the surface, or occasionally by perforated pipes a little below the surface, and none of the sewage is allowed to flow off the land; all must pass through to the deep drains. The researches of Warington point to a great economy in the cost of carrying out the process of intermittent downward filtration in the future. By keeping the superficial layers of the soil in good condition for nitrification, the great expense of deep excavation and preparation of the soil will be saved, and though the land will have to be prepared to a depth of say three feet, so as to secure a prepared stratum beneath the half yard of nitrifying soil, the expense of preparing the land to a depth of six feet—the depth hitherto deemed necessary—will be saved.

Now there is no doubt that broad irrigation, where a sufficiency of land is available, offers a satisfactory mode of disposal of town sewage, and one which holds out more likelihood of realising some portion of the value of sewage than any other, whilst it need cause no danger to health; for Dr. Tidy is almost singular in his observation that he has known a case of disease (typhoid fever) caused by eating vegetables (water-cresses) grown on a sewage farm. The effluent may by this means be effectually purified, and without causing nuisance. Too often, however, careless management leads to nuisance and an incompletely purified effluent. There is some danger, too, of pollution of water-supply when large quantities of this are drawn from wells sunk into the adjacent and subjacent strata. But this is an evil

attendant upon all disposal of sewage upon land. Broad irrigation is, nevertheless, not often applicable to the sewage of large towns, on account of the difficulty of procuring a sufficiency of suitable land, porous, undulating, and at such levels as to obviate as far as possible expensive pumping. Oftener for large towns filtration offers superior practical advantages, less land being required, and the efficiency of action being comparable with that of broad irrigation, as regards the purity of the effluent. Very careful management is, however, required.

There is a vulgar but erroneous notion prevalent, that sewage can be effectually treated by means of chemical substances alone. It is true that by the addition of such matters the stench of putrescent sewage may be removed, and decomposition for a time retarded; but if all active change in sewage is to be prevented, this necessitates such a large addition of chemicals as to entail a serious cost. Anything that will effectually destroy the spores of bacteria, or deprive them of potential life, will certainly render the treated sewage unfit to be disposed of anywhere: for by such addition it will become a poisonous liquid. It cannot be denied, nevertheless, and I freely concede the point, that the chemical treatment of sewage is of great advantage: a chemical treatment directed, not to the end of rendering the sewage non-putrescent, but the end and aim of which is mainly clarification. Since the greater part of the valuable manurial constituents of sewage are soluble, and cannot by any known practicable method be precipitated from so dilute a liquid, it may appear at first sight surprising that the mere clarification of sewage can be very advantageous—more especially when we know that the matters suspended in sewage, or precipitated from it by chemical processes, are comparatively valueless as manure. It is well known, however, to those practically acquainted with sewage disposal, that the solids of sewage are the chief source of the difficulties attendant upon its disposal. They subside with great difficulty and slowness, and hence render a stream into which raw sewage is cast turbid and unsightly, to say the least. When crude sewage is applied to land, the solids greatly impede the penetration of the sewage into the soil, and give a varnish-like aspect to this; a coating which prevents due aëration and oxidation. Organised bodies—such as bacteria and their spores—are of course solid bodies, and remaining suspended in the sewage, and by their adherence to the other suspended solids, rapidly set up putrefactive changes. The sliminess of sewage and sewage deposits is due to the suspended

solid matters, the mucus from the bowels, the grease of our kitchens, the fat of soap, etc. Let two examples of the same sewage be allowed to stand side by side, under similar conditions, except that the one is crude or raw, and the other has been clarified by any simple means. In a few hours the difference between the two samples will be very striking; the one is putrescent, whilst the other exhibits for a time little change in appearance. As to the agents to be used for the clarification of sewage, if the sewage is to be used for broad irrigation, simple straining through coke filters is usually adequate, the coke being utilised in the furnaces always found on sewage works. When land filtration is the plan adopted, something more than this is advisable; and where the effluent sewage is to be thrown into a stream, without being passed over or through land, efficient clarification is indispensable; such a clarification as leaves, generally, less than a grain of suspended solids in each gallon of effluent. And even with this degree of efficiency, I am of opinion that except when the volume of the running water, into which the effluent is to be turned, is enormous in proportion to the sewage it is to receive, no "precipitated", as it is termed, *i.e.*, clarified, effluent, ought to go directly into a stream. Such effluents, however good in appearance they may be, are prone to change, and have a distinct tendency to putrefy; and they require either to be passed through land, or to have a good "run", as it is termed, in an open channel, so as to secure aëration and the commencement of nitrification, before they are discharged into a stream of fresh water.

The agents to be used for precipitating sewage may be varied, and must necessarily be dependent upon the mineral composition of the water-supply, and hence of the sewage of the town. Lime has been nearly universally selected as the chief substance, not only on account of its reasonable efficiency, but also on account of its cheapness. Most of the other substances employed are, in fact, mere adjuncts or accessories to lime, and often add unduly to the cost of precipitation. Indeed, where land is to be used for the subsequent purification of the effluent, lime alone is perhaps preferable on the whole to anything else. A little sulphate of alumina added after the lime is a beneficial refinement, as the resulting precipitate of alumina, by its flocculence, carries down with it those finer suspended particles, including the lower organisms and their spores, which are so difficult to remove by lime alone. But the lime must be employed skilfully, and according to certain principles that are too little understood, and too

often neglected. The lime should be dissolved; and too much trouble cannot be taken to effect this. Mr. Dibdin has discovered experimentally, what had previously been worked out practically at Bradford, that the efficacy of lime is greatly increased by bringing it into actual solution before adding it to the bulk of the sewage. Dissolved lime is four times as efficacious, as a precipitant, as the same lime when simply mixed with water (milk of lime). Since water or sewage is capable of taking up not more than ninety grains of lime per gallon, the proportion of water necessary to be ground up with the lime used can be readily calculated. Fifteen grains of lime to each gallon of sewage is an ordinary proper portion; and with this proportion it is necessary to pump one-sixth of the sewage into mixers, for thorough incorporation with the lime, and then to run the mixture into the remaining five-sixths of the sewage, and thoroughly agitate. It is well known to chemists how greatly subsidence of precipitates and clarification of liquids is facilitated by vigorous agitation, followed by subsequent complete rest. The action of the lime is threefold: it precipitates, in a flocculent form, the carbonate of lime dissolved in the sewage; by combining with the carbonic acid of the liquid, it gives a further precipitate of carbonate of lime, and by combining with some of the organic matters, an additional precipitate is produced. Varying quantities of organic matter are thus removed from solution—one-fourth to one-half, perhaps. The precipitates produced carry down with them the suspended matters of sewage. The proportion of lime should be carefully limited; an excess is hurtful. Hurtful by reason of the greater proneness to putrefy (*pace* Dr. Frankland) of alkaline as compared with acid liquids; hurtful by reason of the detrimental influence that alkaline liquids exercise upon nitrification. Warington's recent researches shew that lime may entirely prevent nitrification. If the lime be carefully adjusted to the average composition of the sewage, this inhibitory action need not, however, be feared. Provided the slaked lime added do not exceed the hardness of the water-supply, *i.e.*, one grain lime per gallon for each one degree of hardness of water-supply, no appreciable excess of free lime will remain in the effluent. And the above proportion, if the lime be dissolved, is more than ample. One of the advantages of the addition of sulphate of alumina to sewage after treatment with lime, is that thereby any slight excess of free lime is neutralised and converted into neutral sulphate of lime.

The addition of a small quantity of green vitriol (proto-sulphate

of iron) to the sewage as an additional precipitant is, in my opinion, highly beneficial; this substance fulfilling an useful and important function, not fulfilled by the substitution of any other chemical for a proto-salt of iron. The lime secures the precipitation of a highly flocculent hydrated protoxide of iron, which acts as a carrier of oxygen, absorbing free oxygen, and again giving it up to organic matters, just as the red blood pigment absorbs oxygen to again give it up to the effete tissues. When the iron salt is used, a small quantity of a soluble proto-salt of iron remains in solution in the effluent, and acts as a very efficient carrier of oxygen. But the use of proto-sulphate of iron is attended with blackening of the mud-banks in the stream into which the effluent sewage is discharged, and although this is a mere sentimental disadvantage—or rather in reality an advantage—it cannot be altogether lost sight of. The blackening is due to the formation of sulphide of iron, by which the unoxidised sulphur of sewage is fixed, and deodorisation effected. I am not sure, however, that sewage when treated with sulphate of iron is so applicable to land, as when the iron salt is omitted. And, indeed, if land-filtration is used to supplement a precipitation process, the use of green vitriol is unnecessary, and may be spared on account of its cost.

So useful has treatment with a proto-salt of iron proved, that a novel, and it is said successful, treatment of sewage has recently been adopted at Buxton, where a natural chalybeate water is employed as the precipitating agent for sewage.

Whenever a precipitation scheme is adopted, the resulting sludge has always presented the crucial difficulty: how to get rid of it has been the troublesome question. Happily the problem is no longer one of insuperable difficulty. The novel application of filter presses enables us to speedily convert a black, putrescible, slimy mud—nine-tenths of which is water—into an almost odourless, friable cake, very little prone to change, and of one-fifth only of the weight of the sludge from which it has been prepared. The process, nevertheless, entails no little cost. Again, the sludge may be deposited on a small area of land, as is done at Birmingham, and with no considerable nuisance, which, moreover, is confined to a small area. Or, perhaps, we shall see adopted the suggestion that the sludge shall be burnt, and its ashes only returned to the soil. Anyhow, this sludge disposal is a matter of no serious difficulty, if we bear in mind that the precipitate is almost valueless as a fertiliser.

So far as I can foresee, the sewage disposal of the future for our

large towns will be one where application to land supplements a preliminary precipitation process; and the land treatment will be a filtration process, by which the area of land requisite will be limited. Such a combined process fulfils all the requisites of good purification, and is based upon these fundamental data. The sewage must be dealt with speedily, before putrefaction has begun; and the agents of putrefaction, the bacteria, must be removed by clarification, which secures the removal of most of the bacterial organisms. The precipitated and clarified sewage is then to be brought as speedily as possible under oxidising influences, and nothing more effectively does this than the bringing of the sewage under the influence of the nitrifying organism. Putrefaction and nitrification are antagonistic processes; and so long as nitrification is going on, putrefaction is, I believe, impossible. Sewage when clarified by any simple process,—and the simpler, perhaps, the better,—and then passed through land, is odourless,—and this cannot, strictly speaking, be said of sewage simply precipitated,—and is also insusceptible of putrefaction. Anything that falls short of the results obtained by the combined process I have referred to cannot be considered a very desirable mode of sewage disposal, albeit a less efficient process may, under certain circumstances, be permissible.

Discussion.

The President, in moving a cordial vote of thanks to Dr. Thomas Stevenson for his interesting paper, said they would all be sorry to hear of the author's indisposition, which prevented his attendance that evening. The subject was one of great importance, and had been dealt with recently by a Royal Commission.

Dr. Edmonds said that the paper stated that the material from the sludge was valueless as a manure, but at Aylesbury, he was informed, that it sold at £3 10s. per ton. The process there adopted was a most interesting one, blood was mixed with the sewage, and the whole very carefully clarified. The result was that there was a beautiful colourless liquid—nothing clearer in any mountain lake. It was a question whether precipitating processes did not act more in this way than Dr. Stevenson gave them credit for. As to lime, in the precipitating process at Aylesbury the whole of the effluent was acid, the lime did not enter into the precipitation at all; the only materials used being alum, blood, and charcoal.

Dr. Drysdale said they were all chemists enough to know that

the nitrogen in their food had been stored up for long years, and was afterwards discharged into the ocean. That was an important problem for the human race. If they sterilised Canada and America, they would, in the long run, find themselves not getting food. They had a great quantity of nitrogen sent to them from this continent, and it was now proposed to take it to the sea, to increase the fisheries. If that was all they could do, the resources of science were not very great. He had visited the sewage farms of Paris, where the sewage irrigates 1,000 acres or more; the effluent was actually made drinkable. What was to prevent this being done in respect of London? Professor De Chaumont had stated that there was quite enough land on the northern shores of the Thames for the purpose. He believed that they would be obliged to eventually dispose of the whole of their sewage by passing it through the land.

Dr. BERNAYS said that there was nothing more barbarous than the present treatment of London sewage. He believed in the treatment of sewage through the land. Some very absurd experiments had been made upon land which was not suitable, under improper conditions. With regard to precipitation, there was an admirable method employed at Birmingham, and the water which flowed through the land afterwards was beautifully pure, with a very small quantity of organic matter. He had known very successful applications of lime. In a solid form a large excess of lime facilitated nitrification, but not a solution.

Mr. ROGERS FIELD thought that the extravagant notions, as to the value of sewage, had done much to hinder a proper disposal of sewage. There had been all sorts of companies formed to utilise sewage, but none of them had done well. He was aware that the proprietors of the A. B. C. process said they got £3 10*s*. per ton for the manure they manufactured from sewage, but there was great incredulity about this amongst competent judges. One important component of sewage, he thought, had been overlooked, viz., paper. There was an enormous quantity of paper used in water closets, and this, when dissolved, was one of the causes of the slimy nature of the sewage-sludge, which was such an intractable and difficult product to deal with. One remark in Dr. Stevenson's paper, he thought, might easily be misunderstood and lead to trouble in practice, viz., that the researches of Warington, on nitrification, point to a great economy in the preparation of land for intermittent downward filtration, by employing a shallower depth of land than had hitherto been deemed necessary. As to nitrification, he was not able to give

an opinion, but, looking at the question practically, the suggested depth of 3 feet was not sufficient to prevent the sewage passing directly to the land drains in an unclarified condition. The drains ought to be 5 or 6 feet deep. In those exceptional cases, when it was necessary to excavate the subsoil, an economy might, no doubt, be effected, as, although the drains should still be 5 or 6 feet deep, only the subsoil need be excavated 3 feet instead of 6 feet. In ordinary cases, however, where the surface preparation and deep drainage were the chief items of expense, he did not see how the economy was to be effected. Dr. Frankland had stated, in the Report of the Rivers Pollution Commission, that the sewage of 3,300 people could be disposed of on an acre of suitable land; but this had been very much questioned. It was, however, a positive fact that a result almost equal to this had been obtained at Kendal ten years ago; and as he had himself carefully investigated the details, the Society might like to know them. The population of Kendal at that time was 13,700, and the average quantity of sewage (which was only about half the strength of London sewage) was at least 1,000,000 gallons a day. The net quantity of land to which the sewage was applied was only 4 acres, 2 roods, and 25 perches, giving 2,942 people per acre. The whole of the sewage of Kendal was disposed of on this very small quantity of land for upwards of three years, and then more land was used. Before this was done, he took samples of the unsewaged soil and of the sewaged soil at different depths, and had a series of analyses made by Dr. Dupré, of which he handed in a copy.

Analyses of six samples of soil from Kendal.

No. I.—Un-sewaged soil.
No. II.—Sludge on top of soil in filter bed.
No. III.—Soil 1 inch thick just below sludge.
No. IV.— „ „ from a depth of 6 inches.
No. V.— „ „ „ 1 foot.
No. VI.— „ „ „ 2 feet.

100 parts of the soil, calculated dry, contained—

	I.	II.	III.	IV.	V.	VI.
Ammonia	0.0026	0.0314	0.0043	0.0039	0.0010	0.0008
Nitric acid	0.0077	0.0098	0.0076	0.0115	0.0157	0.0112
Organic nitrogen...	0.1178	0.2124	0.1983	0.0715	0.0460	0.0438
Total „ ...	0.1218	0.2415	0.2046	0.0785	0.0520	0.0482
Organic matter ...	6.81	8.58	5.56	5.50	3.09	2.68
Phosphoric acid ...	0.0214	0.0344	0.0268	0.0214	0.0166	0.0141

"These analyses not only shew that the portion of unsewaged soil contains a greater proportion of nitrogen than the deeper layers of sewaged soil, but also that the influence of the sewage has scarcely affected the soil below a depth of about 6 inches."

A number of analyses were also made of the sewage, and the conclusion Dr. Dupré arrived at was as follows:—

"Comparing these results with the composition of average London sewage, as given by Professor Frankland, it will be found that this sewage contains about one-third the proportion of chlorine and rather less than that proportion of total nitrogen. Seeing, however, that the proportion of organic nitrogen rises to about one-half, and organic nitrogen must be taken as a very much more serious polluting agent than nitrogen in the form of ammonia, and that the proportion of organic carbon is actually twice that of London sewage, we may, I think, fairly calculate, as far as polluting power on soil is concerned, that this sewage is equal to average London sewage diluted with from two to two-and-a-half times its bulk of river or subsoil water.

"14 July 1877. "(Signed) "A. DUPRÉ."

From these it would be seen that the influence of the sewage had scarcely affected the soil below a depth of about 6 inches. The soil was of a very fine, free character, and the sewage was very well clarified. The growing crops were very large, and considerable returns were yielded. The sludge was intercepted in tanks, and mixed with ashes, or dug into the land. That was easy at Kendal; but in the case of London, with four millions of inhabitants, it would be a different question. As to the filter presses, he had been rather amused at these being brought up now as something new, when in fact they were, to his knowledge, in use at Leicester 30 years ago. The sewage was there treated with lime, and the result was satisfactory so long as the lime was applied in proper quantities—one ton per million gallons, or 15½ grains per gallon. The filter presses, however, did not pay, as they only added to the cost of treating the sludge without improving the sale.

Mr. WYNTER BLYTH said that if the author of the paper had been present, he would have criticised one point, where he doubted whether sulphate of iron was of manurial advantage. He must have overlooked a very good paper, read at the Chemical Society by Dr. Griffiths, of Manchester, on sulphate of iron as a manure. The paper of Dr. Stevenson was a very hopeful one, and impressed him with the importance of the researches upon nitrification.

Mr. CORNER was not satisfied that Dr. Stevenson's suggestions could be practically applied to the metropolis. The soil must be of a proper description, and there must be other advantages to carry out the system.

Dr. EDMONDS spoke of the unsatisfactory experiments at Wimbledon, where the authorities had been proceeded against for creating a nuisance.

Mr. JACOB, as representing an extra metropolitan district, in which

there were several small towns, saw a difficulty in the treatment of the sewage over the land, for the reason that, in one portion of the district, the land was open and porous, and in another portion it was not so. He wished to know what was the best process where there was a stiff soil at the lower end of a district. Local bodies looked to their medical officers, their chemists, and their engineers for advice on the subject; but there was still a very great haziness over the question.

It was here suggested, in answer to Mr. Jacob, that if there was a suitable soil at the upper end of the district, the sewage from the lower end could be pumped up, as had been done in other cases.

Dr. SAUNDERS thought the question of treating sewage had been much obscured by the question of cost. If people would adopt a precipitation scheme and then filtration through the land, there was no question that they would get a good effluent. As to the blood which Dr. Edmonds mentioned as being a part of the A. B. C. system, it was omitted very often altogether; and as to whether it was desirable to collect the sewage in tanks and do nothing more, his conviction was that to do that would be worse than doing nothing at all, because the incoming sewage would become tainted with what was already there. He doubted whether anyone had paid as much as £3 10s. per ton to the A. B. C. Company.

Mr. ROGERS FIELD, in response to a request of the President, said, with reference to Dr. Jacob's remarks, that it was impossible to advise as to particular localities, and each case must necessarily be dealt with itself, when upon the ground. As to the advisability of having a chemical process applied before putting the sewage on the land, that would vary with circumstances. He did not think it was necessary in the case of small populations. He agreed with Dr. Saunders that it was a mistake to retain sewage in tanks, unless a chemical process was applied. In answer to a question, he said that evidence had been given that there was a sufficiency of land of the required quality for sewage disposal in the valley of the Thames.

AN OUTBREAK OF DIARRHŒA TRACED TO POLLUTED WATER.

By F. E. ATKINSON, L.R.C.P.Lond., M.R.C.S.

(*Read*: *May 15th*, 1885.)

Although only a recently elected member of your Society, I have ventured to appear before you this evening, to give you the results of a recent inquiry I have made into an outbreak of Dysenteric Diarrhœa, which occurred in October last at Settle and Giggleswick, in the Rural Sanitary District of Settle, one of the combined districts of Craven, over which I have the honour to act as Medical Officer of Health.

If the evidence I can lay before you is sufficiently strong, I believe I am correct in stating that this is the first published record in this country of an epidemic of diarrhœa which has been conclusively traced to the pollution of a public water-supply. I have the support of the *British Medical Journal* in saying this, for in their issue of the 25th ult., they remarked: "If the recent serious outbreak of diarrhœa at Hull should eventually prove, as suspected, to have been related to the pollution of the water-supply, the epidemic would, apart altogether from its magnitude and local importance, be of interest as the first of its kind that has been recognised in this country as due to polluted water. Of cholera-epidemics due to this cause we have abundance of examples, and of typhoid fever epidemics, too many to be counted; but it chances that *no epidemic* of water-borne diarrhœa has been recorded."

This, then, I must plead as my excuse for bringing this subject before your notice; and after you have heard the details of the outbreak, I shall be glad of your opinion as to whether I was justified in my conclusions as to its cause.

Settle is situated on the east bank, and Giggleswick on west bank, of the river Ribble, and what is known to geologists as the "Craven fault" passes obliquely through them. The area of Settle township is 4,490 acres; that of Giggleswick is 4,338 acres. Their populations at the census of 1881 were 2,213

and 976, living in 452 and 162 houses respectively. The present population of the town of Settle is about 2,145, living in 429 houses. That of the village of Giggleswick is 636, living in 106 houses. During my absence from home, on October 25th, I received intimation of an unusual prevalence of diarrhœa in Settle. I immediately returned home, and commenced a house-to-house inquiry into the extent and origin of the epidemic. From the information collected, it appeared that the actual outbreak, to which this paper particularly refers, commenced on the 18th of October, and terminated on the 28th, during which eleven days there were no less that 180 cases. I have, however, embraced a longer period of time, viz., from October 5th to November 5th, in order to show more distinctly the extent and limits of the epidemic.

During this period there were 218 cases, in 120 houses having a population of 621. Of these, 188 occurred in Settle, and 30 in Giggleswick. The percentage of those attacked to the population of the houses visited by the disease was, in Settle 37.9, in Giggleswick 23.8, or a percentage of 8.7 and 4.7 to the entire population of Settle and Giggleswick respectively.

On reference to the Disease-Chart A, for Settle, it will be seen that, whereas there were few cases, varying from 0 to 3 daily, between October 5th and October 18th, on that day the number suddenly increased to 9, and went on daily increasing until October 23rd, when the epidemic reached its height, and there were 27 cases. On the 24th a sudden drop in the number of cases will be observed, and though the daily decrease was not uniform, we may consider that from this date the epidemic gradually declined until the 29th, when it practically ceased as suddenly as it had begun.

A reference to Disease-Chart B shows a similar, though not so clearly-marked, history in Giggleswick. Of the 30 cases recorded, 22 occurred within the assigned limits.

In warm weather, and at this period of the year, few communities are entirely free from diarrhœa ; and in such an exceptionally hot and dry summer and autumn as we had just experienced, a prevalence of diarrhœa was to be expected ; but, on reviewing the history of this epidemic, it will be seen that something beyond the ordinary exciting causes of diarrhœa was at work, apparently between the 17th and 29th of October, to account for the sudden rise and fall in the number of cases, and for the marked change in the characteristics of the disease itself.

Character of Disease.—The severity of the disease varied con-

siderably, from simple looseness of the bowels to dysenteric diarrhœa, with all its characteristic accompaniments. The attack was ushered in in many cases by a rigor more or less marked, with a temperature of 102° F. The patient complained of headache frequently above the eyes, and nausea, with severe colicky pains in the lower part of the abdomen. These pains generally preceded by some hours the diarrhœa, which was in many cases accompanied by vomiting. In some cases the vomiting occurred only at the commencement of the illness, in others it lasted throughout the attack. The evacuations were watery and very offensive; and contained mucus and more or less blood, in many of the cases. In some instances, shreds and even rings of mucous membrane were passed from the bowel. The tongue was furred, and there was frequently great thirst. General aching of the limbs was often experienced, and in a few of the worst cases there were cramps in the limbs. These symptoms were followed by a sense of weakness and prostration, in two or three instances amounting to collapse, with blue lips and fingers. Delirium and obstinate hiccough occurred in a few of the worst cases. The duration of the attack varied from a few hours in the mild cases to a fortnight in the severer ones. In several instances there was a relapse, taking place after three or four days' freedom from the disease, the relapse being as severe as the primary attack. Convalescence was slow and gradual. There was only one death, and this was not directly attributable to the disease, as the woman was in a weak state of health, and suffering from chronic bronchitic asthma. One of the peculiarities of the disease was its greater prevalence among adults than young children.

Of the persons attacked, it will be seen, in the table of ages below, only 36 were children under 5 years of age, of which only 6 were infants under one year, as compared with 182 among persons over 5 years of age.

Table of Ages.

Age.	Settle.	Giggleswick.		
Under 1 year	5	1	36 under 5 years.	
1 to 3 years	14	2		
3 to 5 „	13	1		
5 to 15 „	31	5	182 over 5 years.	
15 to 25 „	36	3		
25 to 60 „	72	11		
Over 60 „	17	7		
Total	188	30	...	218

I examined the school registers, and found that the epidemic did not in any marked degree affect the number of attendances.

Investigation.—The symptoms above enumerated being those of acute irritant poisoning, suggested to my mind, at first, the suspicion of dangerous adulteration of some common article of diet; and, in my house-to-house visitation, I enquired carefully into the consumption of the following articles of food:—Milk, butter, cheese, tea, coffee, tinned and preserved meats, fresh meat, pork, sausages, ham, bacon, lard, fresh, salted, and cured fish, shell fish, fruit, vegetables, mushrooms. It was soon manifest, however, from the tabulated results, that there was no evidence to show that any of these were to blame.

I attempted to differentiate between the diet of those persons attacked by the disease and those who escaped, but without result. It appeared now that there were only two elements common for the most part to those attacked, whose contamination would be likely to cause so extensive an outbreak, viz., air and water.

At present I confine myself to the possible contamination of air, by the escape of sewer gases into the houses.

The prevailing wind taken during August, September, and October at Long Preston, a village six miles distant from Settle, is shown in a diagram which is exhibited.*

Sewerage System.—The private drainage connections with the main sewers were made in 1879, under the superintendence of a clerk of private drainage works, appointed by the Sanitary Authority, and were carried out in accordance with regulations drawn up by Dr. Barry, then Medical Officer of Health. Since that time the same regulations have been in force with regard to all new buildings connected with the sewers. During the course of my inquiry I examined the private drainage of the premises where cases of the disease had occurred, and found the methods of disconnection to be satisfactory, and in only one instance was complaint made of any drain smell in the house.

The main sewers constructed to carry sewage only are all laid in straight lines, and have inspection shafts at every change of direction or gradient. They are ventilated by means of gratings connected with the manholes at the level of the roads, and by shafts at one or two of the highest points in the system. They are flushed by Field's self-acting flushing tanks, placed at the heads of the main sewers in Settle and Giggleswick.

The sewage is ultimately dealt with by irrigation. At the com-

* This diagram is not reproduced.

mencement of the epidemic, the flushing tanks could not act as frequently as usual on account of the scarcity of water. Complaints were therefore made of the smell issuing from the road ventilators, which were more offensive than usual. These, however, were only objectionable to occasional bystanders, as the smells emitted were rapidly diluted and diffused.

The sewerage system is common to Settle, Giggleswick, Langcliffe, and Stackhouse, and it is interesting to note that, at the time of the epidemic, there were no cases in Langcliffe and Stackhouse.

Water-Supply.—The Settle Water Works were reconstructed by the Sanitary Authority in 1882, when they bought over the plant of the Settle Water Works Company, together with their water right, and the property known as the Dog Kennel Mill and Dam, which latter had been converted into a reservoir. It is a gravitation scheme, and the supply is a constant one, and supplies Settle and Giggleswick only. From this it will be seen that the chief supply is obtained from springs situated in the breast of a hill, in a pasture know as Scaleber. The water is collected by means of rubble drains into a receiving house. From this it is conveyed in a 6-inch pipe down the pasture, and across the road to another little covered house at the S.E. corner of the reservoir. Here it may either enter the reservoir or pass along a pipe at the side of the reservoir direct into the main to the town. Both receiving-houses are provided with a by-wash for the overflow in wet weather. The reservoir measures 92 ft. by 34 ft., and has a capacity of 70,000 gallons. The sides are of brick, and the bottom concreted, and the rose at the head of the main leaving for the town is situated in the middle of the W. side, at the height of 7 inches from the bottom. There is no filter. The reservoir is entirely uncovered, and its surface is exposed to the air, and light and heat of the sun's rays.

At the N.E. corner of the reservoir there is another inlet, provided with a disc, where a supplemental supply (for use in case of emergency), known as Barker's Beck, may at any time be admitted into the reservoir. It commences in high land at the corner of a field, where it receives the overflow from two cattle troughs (Nos. I and II), situate above, which are supplied from a spring higher up. It then runs open, skirting the side of the hill for some distance, and then is conveyed in a covered drain across a road to supply cattle trough (No. III), in a field. From thence it passes open down the field to supply trough (No. IV) in the next field. It next re-crosses the road open, and is covered down to the bottom of the

field, where it is joined by another tributary. This small stream commences in some boggy ground in the field above on the breast of the hill. The two run for a short distance in an open ditch, from the end of which the water is piped across a small paddock to the side of the main road, where it is open as a drinking-place for cattle. It is then covered in a rubble drain across the road, through a meadow, where it supplies two troughs, and then passes to the N.E. corner of the reservoir, where it can either enter or be turned down the by-wash.

A portion of the water works still remains to be described. Twenty-nine houses, representing a population of 145, in the highest part of Settle, are situated at too high an elevation to be supplied from the reservoir. A main is therefore taken direct from the top receiving-house to supply these houses.

Condition of Supply.—In spite of the exceptionally low rainfall, and prolonged high temperature during the past summer and autumn, the water-supply to the town has remained constant, and its use for domestic purposes been unrestricted; but, as I before remarked, it has been insufficient for the flushing of the sewers.

On October 13th the water in the reservoir was at its lowest point, its depth above the rose being only 1¼ inches; and there was already a certain amount of vegetable growth at the bottom. On the 14th, as it was feared that the water would run short, the supply from Barker's Beck was turned in. The supply, as already stated, is only used in case of emergency.

On examination of the course of Barker's Beck (already described), I found that there were large accumulations of cow-dung and other filth round troughs Nos. III and IV, and to a less extent round troughs Nos. I and II, where the animals had been accustomed to drink all through the summer; and the percolations from these would of necessity find their way into and pollute the stream which was now turned into the reservoir. In a wet season the dilution of the water would probably have made it comparatively innocuous, but under existing circumstances the water must have contained both animal and vegetable organic matter in a concentrated form. This, added to the existing vegetable contamination of water in the reservoir, amounted to a gross pollution of the public supply, and afforded reason for suspicion that here was the original cause of the epidemic.

On October 24th the reservoir was turned off from the town, the supply being delivered straight from the receiving-house down

the side main ; and a sample of water was collected by the clerk during my absence, and forwarded to the county analyst for analysis. His report was favourable, and was as follows :—

The sample was free from suspended matter, clear and colourless, taste—normal, smell—none, and gave the following results on analysis :—

Total solid matter 15·26 grs. per gall.
Non-volatile matter 13·02 Do.

Loss on ignition 2·24 Do.

Chlorine=0·90 grs per gall., equal to Chloride of Sodium 1·48 grs.

Nitrogen, existing as Nitrates and Nitrites—very slight trace.

Lead and other poisonous metals—none. Total hardness=11·5 degrees.

The Oxygen required by the changeable organic and other oxidisable matter amounted to ·096 parts per million of the water.

On distillation, the sample yielded :—Free ammonia=0·20 parts per million. Albuminoid Ammonia=·100 parts per million. These results uniformly correspond to those characteristic of a pure water. They afford no ground for suspicion of contamination by sewage or similar impurity.

The reservoir was cleaned out on the 28th, and four barrow loads of slimy green vegetable matter were removed. Two months had elapsed since the reservoir was last cleaned.

It will be noticed that of the total of 218 cases, no less than 199 occurred in houses using the public supply, while only 19 cases occurred in 12 houses using other supplies. In disease-charts A and B, cases using the public supply are coloured *blue*.

Table showing number of houses attacked and source of water-supply.

	Total houses.	Public supply in use.	Houses having cases.	Other supplies in use.	Houses having cases.
Settle ...	429	363	90	66	10
Giggleswick ...	106	94	18	12	2
Total ...	—	—	108	—	12

Connection between Water-Supply and Disease.—We are now in a position to consider what connection may be traced between the condition of the water-supply and the history of the epidemic.

1st. It has been shown that the reservoir at the time of the outbreak was in an unwholesome condition.

2nd. The coincidence of the dates affords the most striking proof of the connection between the water-supply and the epidemic.

Barker's Beck, a stream polluted with animal filth (as has been

already shown), was turned into the reservoir on October 14th. The use of this water seemed to produce no evil result until October 18th, thus allowing 4 days as the period of incubation. Assuming this as the incubation period, it is interesting to observe that after the 4th day (October 28th) from the turning off of the water in the reservoir from the town on the 24th, the epidemic ceased. (See lines indicating periods in Disease-Charts A and B.)

3rd. Further confirmatory evidence is derived from the fact that in the area supplied from the top receiving house to the 29 houses in the highest part of Settle there were no cases.

4th. Again, at Giggleswick Grammar School (a resident community of about 180 persons), which has a separate source of supply, there was no sign of the disease; and generally speaking, in those houses in Settle and Giggleswick which made use of private supplies of water there was no diarrhœa. I have stated in a previous part of this report that in 19 instances, cases of diarrhœa occurred in 12 houses where the public supply was not used. Of these, upon investigation, 5 were found to be children who had drunk water from the public supply at school, 3 were adults who had been working at or visiting in other houses where the public supply was in use, and in these there was evidence that they had taken it. In the 11 remaining cases there was no evidence that they had drunk the public supply.

I do not think that this evidence against the public water-supply is disproved by the favourable report upon it, given by the county analyst. In the first place, only one sample was forwarded, and this was collected at a point in the reservoir directly opposite to where the water from the receiving house enters, and at the greatest distance from the point where Barker's Beck enters, at a time when the reservoir was quite full; and it is evident that the polluting matter would not be equally diffused throughout the water in the reservoir.

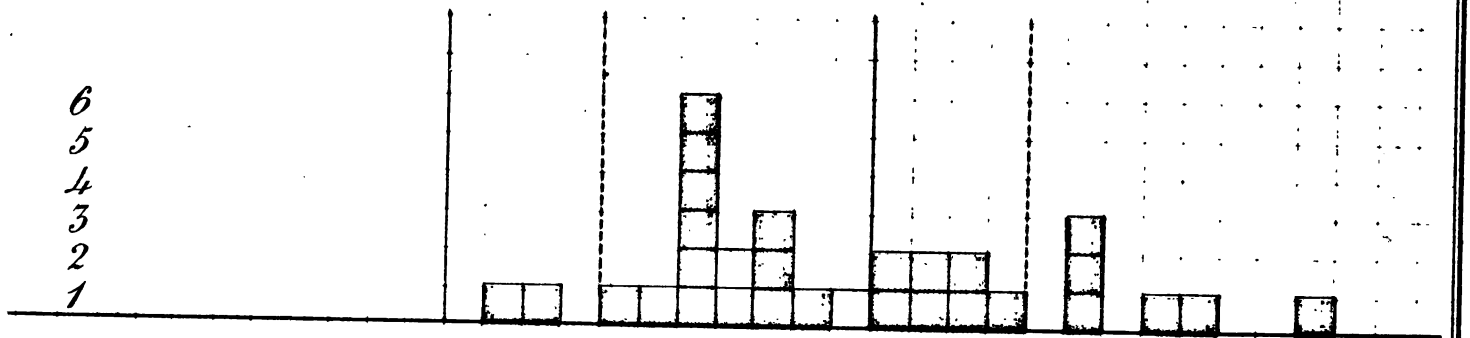
Conclusion.—From the above evidence, I think it will be clear, that the poison which produced the disease was contained in the water in the reservoir, and that this water was the vehicle through which the disease was distributed to those persons who were attacked. Persons who used the public supply taken from above this point escaped, as well as those using water-supplies from other sources. In the only 11 instances of persons attacked who used other supplies, it is quite possible, and even probable, that they had at some time drunk of the public supply, and did not remember having done so.

DISEASE - CHART A (SETTLE.)

6th. 7th. 8th. 9th. 10th. 11th. 12th. 13th. 14th. 15th. 16th. 17th. 18th. 19th. 20th. 21st. 22nd. 23rd. 24th. 25th. 26th. 27th. 28th. 29th. 30th. 31st. 1st. 2nd. 3rd. 4th. 5th. 6th. 7th.

ber

DISEASE - CHART B (GIGGLESWICK.)



NOTE. *Cases marked blue were using the public water-supply*

DISCUSSION.

The PRESIDENT, in moving a vote of thanks to Mr. Atkinson for his interesting paper, said it appeared to him that Mr. Atkinson had proved his case, but he was surprised to hear it said that no endemic of diarrhœa had been previously traced to a polluted water-supply. Specific pollution of water often originated endemics of enteric fever. This had been the case recently at Kidderminster, where pollution of water by sewage, simply, from causes well known in connexion with the constant-service system *minus* cisterns, had previously given rise to febrile attacks of a non-specific character. In London they were not so badly off as regarded the water-supply, and there was, so far as he knew, no cause to attribute epidemic and endemic diseases to the use of water excepting in well known instances of cholera. Disease in single households doubtless had been occasioned by neglect of cleanliness in regard to the cistern. Recently an outbreak of diphtheria was traced to polluted water. There were four cases in one house; the water was unpleasant to taste, and examination of the cistern led to discovery of a bundle of young kittens, which some mischievous person had cast into the uncovered receptacle. There was no diarrhœa in that case; but, reverting to his first observation, he thought it would not be difficult to find recorded cases of diarrhœal disease traced to a polluted water-supply.

Dr. THURSFIELD knew of cases of local epidemics proceeding from water, but he had some difficulty in deciding what the disease actually was. He was, however, fortunate in making a post-mortem examination in one case, and he found symptoms of typhoid fever. Several outbreaks of diarrhœa had come under his experience, in which well-marked cases of typhoid occurred. The question upon the paper read was whether it was diarrhœa pure and simple. He did not think there was any reliance to be placed on the analysis; and a great deal of mischief was done by analysts in reporting water to be pure which was really unwholesome. He had known of instances of sanitary authorities using water upon the certificate of analysts, when it was unfit for domestic use.

Mr. CASSAL was specially interested in the paper in its reference to the analysis. Analysts appeared to be getting a bad time of it at the hands of the Medical Officers of Health; but analytical chemists had to thank themselves in a great measure for this, because of their carelessness in sending out reports on samples of water. It was

much to be regretted that such a report as the present one had ever been sent out. The report stated that the loss in the solid constituents on ignition was 2.24 grains per gallon, but no mention was made of any changes undergone by the residue during ignition, such as browning or blackening, which was the most important point about this ignition test: the chlorine being ·9 grains per gallon, the "oxidisable matter" ·096 parts per million, and there being a "trace of nitrogen as nitrate." The most extraordinary part of the report was at the end, where it was stated that the free ammonia being 0·2 and the albuminoid 0·1 per million, these results "corresponded uniformly with those characteristic of a pure water"; and that they afforded "no ground for *suspicion* of contamination by sewage or similar impurity". The analytical data, such as they were, distinctly gave ground for suspicion against the water, and pointed to the necessity for further investigation. To pass a water as free even from suspicion, in the face of such results, and in view of the serious nature of the case, was a proceeding to be strongly condemned. Such a water ought unquestionably to have been submitted to a careful microscopic examination at least, and the cultivation test might also have been applied. The report only mentioned one sample, but in such a case several samples from different parts of the reservoir should have been taken and examined. Dr. Thursfield had disapproved of founding opinions as to the fitness of water for drinking upon the results of analytical investigations, but if a thorough and complete analysis were made, including microscopic examination and the cultivation test, practically no dangerous water would be passed. Although cases might be conceived of where this would not hold good, he (Mr. Cassal) contended that no such cases could be cited, and that, as a matter of fact, they did not occur in practice. Either the samples were improperly taken, or a sufficient number was not taken; or, on the other hand, the analytical examination was incomplete, or the conclusions drawn from it were unjustifiable. The speaker proceeded to quote the Caterham case, and the report of the Local Government Board thereon, and stated that there was no ground whatever for the assumption that the poison was equally diffused throughout the whole of the reservoir. In the absence of samples of water properly taken, and in the absence of better evidence generally, it was not fair to say that water analysis is not to be trusted. Mr. Cassal concluded by condemning the practice of some local authorities and others of keeping the analyst in the dark as to the sources of waters

sent for analysis, and as to the reasons for the analysis, because they were under the impression that they would thus obtain an unbiassed opinion, and reiterated his objections to incomplete analytical reports.

Dr. SEATON thought that no one ought to give a positive opinion as to the purity of a water-supply who had not a practical acquaintance with the district ; and he defied any analyst to give such an opinion without knowing the particular conditions of the supply. As to diarrhœa, he had not much experience to contribute, but he was very much interested in the paper and with the remarks of the President with reference to the cases at Kensington of diphtheria. He had known of many cases of disease caused by the action of one public analyst, in reporting an impossibility, viz., what the state of the water was previous to his examination. The speaker concluded by referring to Mr. Wanklyn's report on the water-supply to the Leek workhouse, which passed through a peaty neighbourhood, and which gave some people diarrhœa whenever they first drank it. The question arose whether water containing such a thing as a decaying turnip would give the disease.

Mr. ATKINSON briefly replied, stating that to his mind the epidemic in question had no connection with typhoid fever. The symptoms exhibited were distinct, and characteristic of dysenteric diarrhœa, and there was marked uniformity in the character of the disease throughout the epidemic. Its having under these circumstances been clearly traced to the water-supply, pointed, he thought, to a specific contamination of the water. Had he been at home at an earlier stage, he would have collected samples of the excreta for cultivation experiments. With regard to the analysis of the water, a number of samples ought to have been taken from different points in the reservoir ; and in his opinion an analyst should always be informed as to the circumstances and surroundings of the supply before he could come to a just conclusion. One of the speakers had referred to diarrhœa produced by the presence in water of an excess of vegetable matter. He knew that this was laid down as a principle in all text books on the subject, and had known of individual cases in which it appeared to be the cause, but did not know of any recorded epidemic of diarrhœa due to this cause.

THE ETIOLOGY OF GOITRE IN ENGLAND.

By W. N. THURSFIELD, M.D.

(*Read*: *May 15th*, 1885.)

As a rule the subjects which are brought for discussion before this Society relate either to matters connected with sanitary administration, or to infectious disease, or to influences acknowledged to directly affect the health of the community. As goitre may not at first sight appear to belong to either of these classes, it may be as well for me to state that my attention was first directly drawn to this subject, some three years ago, in consequence of my being requested by a sanitary authority to enquire into an epidemic prevalence of goitre amongst the children in some schools in their district. The undoubted epidemic nature of the disease and other facts were so diametrically opposed to the etiological views almost universally given in the text books on medicine, that I was induced to make further investigations as to the general liabilities of the population and physical characteristics of certain districts where goitre was endemic; and, in order to avoid hasty generalisation from general conditions, which may have been merely coincidences, to check these observations by particular enquiries in individual cases, wherever opportunity offered.

I have restricted my conclusions as to the cause of goitre to the disease as it occurs in England, because I wish to confine myself as far as practicable to personal experience, and there may be in other countries contributing causes of which I have no knowledge. It would, for instance, be interesting to know why in India goitre should be nearly as common in men as in women.

For a definition of goitre I do not think I can do better than follow the official nomenclature of the Royal College of Physicians, which defines goitre as "enlargement of the thyroid gland, endemic in certain mountainous districts, but not limited to them." This enlargement depends upon simple expansion, hypertrophy of tissue, or vesicular distension, or a combination of all three, and results from persistent abnormal increase in the blood in the gland or persistent abnormal call upon the physiological action of the gland, and usually

upon both combined. Goitre is much more prevalent amongst females than males, and certainly in my experience affects in undue proportion the industrial class.

The primary causes of goitre are as follows :—

1. Climatic.
2. Physiological, including sex, heredity, etc.
3. Industrial.
4. Dietetic.
5. Neurotic and strumous diathesis.

In localities where goitre is endemic, two of the above causes are always present, and generally three or four, in various degrees of preponderance, and the preponderating cause will often be found to differ in different localities. Sporadic cases of goitre occurring in localities where goitre is not endemic, when not directly imported, are the result of the preponderating influence of some one or two of the above causes, probably conjoined in many instances with the influence of heredity. The causes are mentioned in the order it will be most convenient to consider them. I have not referred to absence of sunlight, confined atmosphere, and other causes considered as contributing in some countries, as these are not in my experience concerned in producing English goitre.

The Climatic Influence.—This is as a rule the chief factor in the production of endemic goitre. Endemic goitre may elsewhere exist in low-lying plains, due doubtless to the combination of some of the causes above alluded to ; but in England, so far as my experience goes, the endemic prevalence of goitre is not found at much less altitude than is indicated by a fall in the column of mercury equal to about three quarters of an inch. This diminished atmospheric pressure in hilly districts, together with the climbing of hills and other conditions leading to sudden alterations in the circulation, combined with the natural distensile property of the thyroid, is, I believe, the origin of the goitrous diathesis.

The Physiological Influence.—In the goitrous districts, abnormal enlargement of the thyroid occurs at any age, up to adult life. At the present moment I could show cases at almost any age, from infancy upwards. It appears, however, usually to show itself from five to twelve years of age, perhaps most commonly at about eight years of age ; but where medical advice is sought, it is not generally until a marked enlargement coincides with the first catamenial period or some other cause interfering with the circulation. It is this cir-

cumstance, I think, which has given rise to the statement found in most text books that it is at the above period that goitre usually makes its first appearance. It is my experience that a much larger proportion of cases of enlargement of the thyroid in a goitrous district will be found in females under the age of thirteen than above it. The enlargement in the majority of cases then disappears ; in some, however, it is persistent, and increases much, and it is these cases which are ordinarily known as goitre. This persistence is owing to causes specially interfering with the circulation of the thyroid or otherwise conducive to hypertrophy of the gland. The cause most directly conducive is, however, diminished pressure of the atmosphere.

Of the thyroid gland little is definitely known beyond its anatomical structure, which is that of a very vascular, ductless gland, with a dual supply of blood-vessels and nerves from different sources. The thyroid has this peculiarity, that of all the glands of the body which we can see and feel, it is most prone to and most capable of alteration in volume, and it is to this peculiarity that goitre is due. It is, in fact, the giving way, under varying degrees of increased force below, or diminished pressure above, of the point of least resistance in the human body externally. In other words, the abnormal and persistent expansion of a structure normally distensile for physiological reasons.

I have no personal information on the point, but it is stated that goitrous tumours increase in size in wet weather, *i.e.*, with a low barometer ; and a locality with a high local humidity might in the same way be a contributing influence.

The functions of the thyroid in the human body appear to be of a doubtful nature; one almost mechanical, the other physiological. One purpose served by the thyroid appears to be to act as a diverticulum for the circulation on the occurrence of arterial tension in the brain or uterus. That it should so act in the case of the intercranial circulation might be anticipated from the very intimate anatomical relation between the arterial supply to both, and cases have been recorded of acute goitre supervening on intense excitement. This function or habit of the thyroid has much to do, as will be presently shown, in the production of goitre. That it does so act in the case of the uterus is also an observed fact, sudden enlargement of the thyroid frequently supervening in connection with menstruation and pregnancy, and in some cases a periodical expansion occurs. As no direct anatomical connection between the uterus and the thyroid is

traceable, we are driven to the explanation of correlation of nerve influence between the two organs. That intimate sympathy exists between the generative organs and those of the throat is obvious from well-known facts ; and the liability of sudden enlargement of the thyroid to follow uterine excitement appears to have been utilised for practical purposes, both in classical and mediæval times. This function or habit of the thyroid would account for the greater liability of the female to suffer from enlarged thyroid.

The thyroid is at all ages normally proportionately larger in the female than in the male ; and the fact, as I have observed, that the preponderance of cases of enlarged thyroid amongst females is found, though, perhaps, not to the same extent, in childhood as in adult life, is evidence that this special liability is not, as has been suggested, owing to the greater use of water as a beverage by females, but is a liability of the sex, and doubtless the result of a natural provision for equalising the sudden alterations in the circulation to which females are specially liable.

As regards the function of the glandular apparatus of the thyroid (the vesicles, etc.), little is known definitely. Physiologists seem generally to agree that the gland performs some office in connection with the composition of the blood. Dr. Baber frequently found the vesicles to contain red blood-corpuscles in various stages of degeneration and decolorisation, and concluded that the gland was concerned in the retro-transformation and excretion of the elements of the red blood-corpuscles. This assumption, if correct, has a most important bearing, and may help to throw light upon the mysterious but undoubted occasional connection between the use of certain drinking-waters and the production of goitre, and will be referred to subsequently in connection with that point.

Goitre has a most decidedly hereditary tendency. I have seen many such cases, both direct and collateral. It has been suggested by Dr. Woakes, on analogical grounds, that this hereditary tendency would be most marked where there was a strumous taint inducing goitre by abnormal relaxation of the arteries of the gland, the result of neurosis of the cervical ganglia. The cases, however, in which I have noticed heredity, have generally been of a high physical standard of development, and of an average intellectual standard.

The Industrial Influence.—That goitre is frequently entitled to be considered an industrial disease I entertain no manner of doubt whatever. Carrying weights on the head or otherwise, so as to

interfere with the cerebral circulation, is a most potent contributing cause. It requires, however, to be combined with the climatic or some of the other influences alluded to, and even in goitrous districts I have obtained strong evidence that for the industrial influence to be operative it is necessary as a rule that it should commence at or soon after puberty. I am well acquainted with two populous localities, both situated at an altitude of about seven hundred feet. In both goitre used to be endemic, and is so, to some extent, at the present time. In both the water-supply is the same as it has been from time immemorial; in both there has been a most marked diminution in the number of cases of goitre, especially of the more severe kinds, and the only alteration in the habits or liabilities of the inhabitants which could at all effect this has been the cessation on the part of the young females of the locality of the habit of carrying weights on the head in their employment in connection with the coal and iron-stone mines, also their daily water-supply, etc.—as having acquired the ability to readily carry weights on their heads, they adopted that mode of carrying everything. The present generation of females in the locality not having had a similar education, carry water, etc., in the ordinary way. Of one of these localities I have intimate knowledge, and well remember as a boy passing through the streets, to have frequently noticed the repulsive-looking, huge, goitrous tumours, of a kind one seldom, if ever, sees now in this country. At the present time the alteration is most marked, and is at once admitted by the older inhabitants. This district is a mining and manufacturing district, more flourishing years ago than now, and situated close to a navigable river, and no explanation of greater mixing of population and cessation of inter-marriage would apply here. The only alteration here has been industrial. Years ago this locality was so notorious for goitre as to give a name to the affection in that part of England. The women were also celebrated for their ability to steadily carry great weights on their heads, and at certain seasons of the year many of them were engaged to go to other localities and occupations, where such an accomplishment was desirable. Following up this clue, I have found several instances of sporadic goitre, where the only member of the family affected with goitre has been the only one who had carried weights on the head habitually; these have generally been people dwelling at a considerable altitude. In carrying weights on the head, the return circulation of the neck is retarded, and the arterial stimulated, conditions directly tending to congestion of the

thyroid; and this I believe to be the most potent industrial influence; but any heavy exertion has a tendency to the same effect, and this would, I think, explain the not unfrequent cases in which domestic servants develop goitre in non-goitrous districts. In these cases there would, I think, generally be present hereditary tendency to goitre, or a strumous and neurotic diathesis. I have ascertained that the traditional practice of one eminent medical man, who practised in a goitrous district in the Midlands before the introduction of iodine, was to strictly enjoin upon his goitrous patients the necessity of not carrying weights on their heads, and to boil the drinking-water. This boiling of the water was probably intended to get rid of some of the lime salts, but it would also precipitate the iron where lime was present.

The Dietetic Influence.—If, in my investigation into the origin of goitre, I could have made my mind a complete *tabula rasa* as to all that I had previously heard or read on the subject, I do not think I should have found it necessary to consider the probable influence of the water at all in the matter. I am, however, disposed to think that in some of the localities water was certainly a contributing cause. In each of these cases a theory of excess of saline and earthy matters in solution, or of iron in solution in small quantities, would have been equally applicable. I have adopted the theory of iron, as it appears to me that it can be more readily and scientifically connected with hyperæmia of the thyroid body than excess of dissolved matter in the water consumed.

In looking through the various text books of medicine, nothing is more striking than the uniformity with which the quality of drinking-water is assigned as the cause of goitre, though on the question of the element in water producing the evil, the diversity of opinion is almost as remarkable. Personally, I venture to express a belief that water is by no means essential to the production of the disease, and has frequently nothing to do with it. That every kind of water, from snow-water downwards, has been credited with producing the disease, is presumptive evidence that water in some instances has had nothing to do with it; and I am satisfied that under favourable conditions of climate and industry, goitre may occur altogether independently of the water; and in the epidemic above alluded to, the water-supply of the majority of cases was derived from the hard Cambrian formation, and, to quote the report of the well-known analyst, Mr. Sutton, of Norwich, was "one of the purest natural waters which had ever come under his notice, or

of which he had seen any record." It did, however, contain slight traces of iron. Indeed, the very fact of the existence of an epidemic is, in the case of such a disease as goitre, strong evidence that water had nothing to do with the disease.

Water has, however, been credited as the cause of goitre from the earliest records of medicine, and there is abundant testimony that it is often a potent contributing cause of the disease. To my mind no satisfactory explanation as to how it acts has yet been afforded, and on this point I speak with special diffidence. The theory I have to offer in the explanation of the goitriferous property of certain waters has, however, I believe, sufficient basis of fact and probability to justify my bringing it before you. Of the numerous hypotheses which have been brought forward to explain the influence of water in the production of goitre, the two which have received most support from observers on the subject, and which appear to have the broadest basis of the fact, are (1) the theory that goitre follows the use of water from magnesian and limestone rocks, and (2) the theory that the presence of iron pyrites in the strata from which the water is drawn is the cause.

I believe that in the coincidence of these two may be found the true explanation, or, to speak more accurately, that the presence of iron in the strata in a form liable to pass into a soluble salt of iron on meeting with the ordinary spring water of the district, may account for the above discrepancies, and afford a rational explanation.

I am quite aware of the objection to the above theory, that iron is very universally diffused and constantly occurs in water where no goitre is found. This would, however, apply with equal force to any of the other properties of water which have been suggested as the cause.

Iron pyrites is insoluble, but when brought in contact with spring water containing carbonate of lime and magnesia in carbonic solution, it gradually passes, by a process of oxidation, into carbonate of iron. This salt of iron is, according to Professor Ringer, most readily and directly assimilated by the system. Now the mode in which the water tends to aggravate or promote goitre may possibly be as follows. Iron is in a certain sense food, and is necessary and conducive to the formation of the red corpuscles of the blood. Administration of iron in anæmia increases the number of the red blood-corpuscles and the amount of iron contained in them; and although such result may not take place in health, it is not too much to assume that a readily assimilated form of iron dissolved in minute quantities in water

would act as food for, and stimulate the production of, the red corpuscles, and so throw more work upon the glands which deal with these corpuscles in the system.

Now the most recent view as to the physiological function of the thyroid appears to be that it is an excretory organ for the effete blood corpuscles; and may it not be that the observed effect is the result of undue ingestion of that form of food with the excretion of which the gland is concerned? I use the word food advisedly, because I believe (assuming the theory to be correct) the result to be due not to the ingestion of large quantities of iron, but to the habitual and constant consumption of minute traces of iron in a most readily assimilable form, and which would pass into the system as albuminate of iron. The carbonate of iron, indeed, under such conditions in natural water would be constantly in a state of change, and would only exist in the water in small amount in ordinary circumstances, and imperceptible to taste, and being a most unstable compound it is readily precipitated. This is a reason why iron in this form is not unfrequently overlooked, as after the lapse of some time and a little exposure the iron is precipitated, and no reaction follows the tests for iron applied to water in ordinary sanitary analysis.

The therapeutic effects of iron may throw some light upon this point. When iron is administered therapeutically, a sensation of fulness and pain in the head sometimes supervenes, and is recognised as indicating the desirability of discontinuing the medicine. This would give support to the theory advanced. On the other hand, anæmia is frequently present with goitre. This may be due to the blood-elaborating function of the thyroid being out of order; but iron is said, in some cases of anæmia accompanied with goitre, to produce marked benefit. I believe these cases will be found where a strumous and neurotic diathesis is the preponderating cause.

In connection with this subject I think it well to refer to the instance, so frequently quoted, of French peasants, who are alleged, in order to avoid the conscription, to artificially produce goitre by drinking goitriferous water. According to the best account I can obtain, the conscripts are said to "go up to Briançon". Now, Briançon is, I believe, upwards of four thousand feet above the sea, and this fact, combined with the goitrous diathesis of many Frenchmen, would be powerful contributing influences.

Is Goitre diminishing in England?—Endemic goitre certainly is. In a disease where the influence of heredity is so marked, we may assume that the endemic prevalence may to some extent, in isolated

communities, have been due to intermarriage, and that increased migration and facilities for travel could certainly tend to produce a decrease; but I am persuaded that the chief cause is due to the disuse of the practice of carrying weights on the head. This would chiefly apply to those hilly districts where a slight contributing influence, in addition to that of diminished atmospheric pressure, is all that is needed to induce the deformity. Throughout England generally there has been, during the last quarter of a century, a marked alteration in the custom of the rural population in the matter of carrying weights. To carry weights on the head safely, and with comfort, requires early training and practice. Before the introduction of tins with handles, the wooden milk pails with side handles were of such a shape and make that when full they could not well be carried by one person except on the head. Hence the early training and acquired facility in carrying weights on the head. The introduction of tin ware with handles has altered this, and led to the disuse of the practice, and, as I believe, may thus be said to have contributed to the diminution of goitre in some agricultural districts in England.

With sporadic goitre in towns the case may be different. This affection is said by some to be on the increase. If this be so, and, considering the element of debility present in so many of these cases, the neurotic influence may be the preponderating one, and the theory advanced by Dr. Woakes is probably correct, viz., that this affection shares in a general increase of neurotic affections in the present age.

Epidemic Goitre.—Time will not allow me to do more than to refer to the epidemic of goitre mentioned in the commencement of this paper. It had been noticed for some months before I investigated it, and the cause I believe to have been purely climatic, probably aggravated by some meteorological condition peculiar to the year.

Connection of Goitre with Cretinism.—On the theory of goitre being a circulatory disease, and dependent to a large extent on atmospheric influences, the connection of cretinism with goitre seems to admit of explanation. In some countries the goitriferous influences, including the strumous diathesis, may be sufficient to produce goitre and cretinism in the same individual. In this country cretins are rare, and in the majority of such cases in which a post-mortem examination has been obtainable, the thyroid has been found absent. Now, assume an infant of a strumous diathesis, with deficient arterial

tone, under strong goitriferous influences. In the absence of the safety-valve action of the thyroid, a cretinous condition would be expected to result. Indeed, the converse may be true, and I have recently met with a microcephalic idiot with a huge goitre.

Discussion.

The President, in moving a vote of thanks to Dr. Thursfield for his very interesting paper, observed that, in all probability, many of those present would be in the same position as himself in having only a theoretical acquaintance with the subject. He appealed to the country members present to favour the Society with their experiences, whether confirmatory or otherwise, of the views of Dr. Thursfield, whose paper would form an interesting item in the next volume of their *Transactions*.

Dr. T. Moore said that his experience in Worcestershire was that goitre was very prevalent there, and he came to the same conclusions as Dr. Thursfield, that the majority of cases were attributable to the women carrying weights on their heads. In nearly every case that came under his notice, the women had done that, and he concluded that the weight must interfere with the circulation. Other medical men to whom he mentioned the cases came to the same conclusion. There was not a great amount of saline matter in the water they drank, and there was a little iron, but he attached no value to this. In India, where both sexes carried weights upon their heads, the disease was very prevalent.

Dr. Seaton asked if the reader of the paper had had any experience in Derbyshire, because he thought that in the hilly districts of that county the disease would be noticed. He had frequently observed the people carrying weights in the Swiss valleys, where goitre was most marked, but it was curious that he did not remember seeing this point referred to in the text-books. The cause assigned by Dr. Thursfield appeared to him to be a very possible and probable one.

Mr. Murphy asked whether Dr. Thursfield could inform the Society whether goitre occurred as frequently amongst men as women in India, and observed that both sexes in that country carry weights on their heads.

Dr. THURSFIELD, in reply, said he was surprised that his paper had been received with so little opposition. Dr. Aitken, whom he knew well, used to refer to goitre as an Indian disease, but without any connection with carrying weights on the head. Goitre in India was as common in the male as in the female. He was gratified to find that carrying weights on the head as a contributory cause had been noticed by someone, but he believed that goitre arose from no single cause.

R F
Tables. 1.

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